

DEPARTMENT OF ENERGY
FY 1991 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

OVERVIEW

UNIVERSITY AND SCIENCE EDUCATION

There is growing consensus that one of the most serious problems facing the nation over the next ten years is the declining number of young Americans, including women and minorities, interested in pursuing careers in science and engineering. This problem is further compounded by the often poor and inadequate preparation received by young students interested in such careers. The crisis in science education has serious implications for the nation's continued international economic and technological competitiveness. Future success in meeting the Department's science, energy and defense R&D missions is also heavily dependent on the quantity and quality of the Department's scientific and technical workforce. In order to carry out these missions, DOE is both a user and a patron of a large fraction of the nation's scientific and technical workforce. The Department and its predecessor agencies have historically supported programs designed to help replenish the nation's scientific manpower pool, while at the same time encouraging young students to pursue scientific and technical careers in fields of direct programmatic interest to the Department.

The University and Science Education Program (USE) and the related University Research Instrumentation Program (URI) have been the primary programmatic approaches used by DOE to strengthen the nation's science education and research infrastructure to ensure their effective contribution to the Department's long-range R&D missions. Much of this support involves the use of the unique facilities and resources at the Department's national laboratories and research facilities to assist in science education from the precollege through postdoctoral levels. The USE program also includes the Department's R&D Laboratory Technology Transfer Program which encourages the development of links between the Department's laboratories and private industry for the purpose of accelerating the transfer of Department-supported technology to the private sector. Specifically, the USE program consists of three major subprograms and a set of interrelated program activities focused on the following primary objectives:

1. Utilize the unique resources of the Department's laboratories (scientists, facilities and equipment) to assist in the national effort to strengthen the nation's economical, technological and educational competitiveness.
2. Strengthen university capability to perform long-range energy R&D;
3. Enhance the quality and increase the numbers of young people, including minorities and women, interested in pursuing energy-related scientific/technical careers;

4. Take full advantage of the unique resources and facilities at DOE laboratories to enhance both university faculty and student research, and precollege science education.

The first USE subprogram, the Laboratory Cooperative Science Centers program, includes support for 1) precollege student and teacher research and training; and for 2) undergraduate, graduate and faculty research appointments at DOE laboratories and DOE university consortia. The critical contributions of the Department's laboratories to science education involving "hands-on" research experiences for precollege and university-level participants have been strongly endorsed by the Energy Research Advisory Board (ERAB), the White House Science Council and the Congressional Office of Technology Assessment. Consistent with these analyses and the President's goal of improving our national science and technology research and education base, the DOE laboratories represent unique resources for the Department's participation in science education.

The FY 1991 request builds on this strong base of involvement of the DOE laboratories in science education at both the precollege and university level and implements the Administration's commitment to improve math and science literacy in the U.S. This commitment was the focus of a Math/Science Education Action Conference cohosted by the Secretary of Energy James D. Watkins and Nobel Laureate Glenn T. Seaborg in Berkeley, California, early in FY 1990. Support will be provided for comprehensive programs at the national, regional and local level conducted at several laboratories that have made an institutional commitment to support science education through the establishment of Science Centers. This includes 1) summer and semester-length research appointments for undergraduate science and engineering students; 2) summer and academic-year appointments for university faculty and graduate students and 3) support for precollege student and teacher research appointments including the prestigious DOE High School Science Students Honors Research Program. Two additional initiatives are proposed in FY 1991. The first initiative will provide support for precollege mathematics education activities undertaken by DOE laboratories in response to recommendations from the Conference Board on Mathematical Science of the National Academy of Sciences. The second initiative involves cost-shared support for the development of travelling museum exhibitions and classroom educational materials on DOE-related scientific and technical program activities.

The second USE subprogram, University Programs, includes support for university-based efforts directed at encouraging more young people, including minorities and women, to pursue energy-related scientific and technical careers. Support will be provided in FY 1991 for a major expansion of the Department's Prefreshman Engineering Program (PREP) to involve 3000 middle-school students in summer workshops on mathematics, science and engineering conducted by universities on their campuses.

The third USE subprogram, University Reactor Fuel Assistance, provides support for refueling and related activities for university nuclear research and training reactors.

The fourth USE subprogram, R&D Laboratory Technology Transfer, provides support to industry scientists and engineers to work on assignment at a DOE laboratory, with laboratory scientists, to transfer DOE-developed technology to the private sector for commercial application. These assignments are cost-shared with industry and involve both large and small companies. Support is also provided for pilot laboratory initiatives to improve the process for transferring Federally-funded R&D to U.S. industry and for improving and broadening communication to the private sector of the technology transfer opportunities available at the DOE laboratories. The R&D Technology Transfer Program supports DOE laboratory efforts to spin-off new technology to U.S. industry and university sectors consistent with P.L. 99-502 and E.O. 12591 to ensure benefits from commercialization of DOE-funded research.

DEPARTMENT OF ENERGY
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 ENERGY SUPPLY RESEARCH AND DEVELOPMENT
 (dollars in thousands)

LEAD TABLE

University and Science Education Program

Activity	FY 1989	FY 1990	FY 1991 Base	FY 1991 Request	Program Change Request vs Base	
					Dollar	Percent
Laboratory Cooperative Science Centers.....	\$11,162	\$11,876	\$11,876	\$18,230	+\$6,354	+ 54%
University Programs.....	6,857	6,761	6,761	1,900	-4,861	- 72%
University Reactor Fuel Assistance.....	2,040	4,059	4,059	7,230	+3,171	+ 78%
R&D Laboratory Technology Transfer.....	1,385	2,219	2,219	2,400	+ 181	+ 8%
Total Program (OE).....	\$21,444 a/	\$24,915 b/	\$24,915	\$29,760	+\$4,845	+ 19%

Authorization: Section 209, P.L. 95-91.

a/ Total has been reduced by \$269,000 which has been transferred to SBIR.
 b/ FY 1990 reflects final Gramm-Rudman-Hollings sequester adjustments.

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SUMMARY OF CHANGES

University and Science Education

FY 1990 Appropriation.....	\$24,915
- Discontinue nuclear engineering research and education program.....	-5,857
- Support student and teacher/faculty research at additional DOE laboratories and laboratory/university partnerships to increase minority student access to energy-related research.....	+ 800
- Increase precollege science teacher research appointments and minority high school student appointments to encourage more students to stay in the math/science pipeline.....	+1,250
- Initiate inner city/rural partnerships designed to revitalize math/science in targeted school districts.....	+1,950
- Completion of university reactor upgrade and reactor housing at Arkansas Technical University.....	-1,826
- Decrease activities in base laboratory cooperative science centers program.....	- 646
- Maintain reactor fuel assistance and manpower development.....	+ 6

- Initiate precollege mathematics science education program at DOE labs.....	+2,000
- Initiate museum-based science education program.....	+1,000
- Provide for program needs for uranium enrichment.....	+5,000
- Broaden focus of Pre-Freshman Engineering Program.....	+ 987
- Maintain support for laboratory technology transfer activities, including visiting industrial scientists appointments.....	+ 181
 FY 1991 Congressional Budget Request.....	 \$29,760

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KEY ACTIVITY SUMMARY

UNIVERSITY AND SCIENCE EDUCATION

I. Preface: Laboratory Cooperative Science Centers

Support is provided for precollege science students and teachers and for university faculty, graduate, and undergraduate students to participate in summer and semester-length research and education activities at DOE laboratories. The objectives of this effort are to provide hands on research experience in cutting edge science thereby stimulating students to prepare for careers in science and technology fields and enhancing the knowledge and skills of their teachers and faculty. The principal approach of this program takes full advantage of the unique resources and facilities at the DOE laboratories for research and support of related education. Support is also provided for high school science student honors research, science teacher research appointments, undergraduate science semester program research, and precollege and university level faculty/student team research at DOE laboratories that have established comprehensive lab coop science education programs.

II. A. Summary Table: Laboratory Cooperative Science Centers

Program Activity	FY 1989 Actual	FY 1990 Estimate	FY 1991 Request	% Change
Laboratory Cooperative Science Centers.....	\$ 11,162	\$ 11,876	\$ 18,230	+ 54
Total, Laboratory Cooperative Science Centers	\$ 11,162	\$ 11,876	\$ 18,230	+ 54

II. B. Major Laboratory and Facility Funding

Ames Laboratory	\$ 95	\$ 83	\$ 99	+ 19
Argonne National Laboratory	\$ 2,729	\$ 2,489	\$ 2,749	+ 10
Brookhaven National Laboratory	\$ 920	\$ 711	\$ 994	+ 40
Fermi National Accelerator Laboratory	\$ 360	\$ 247	\$ 106	- 57
Lawrence Berkeley National Laboratory	\$ 720	\$ 562	\$ 851	+ 51
Lawrence Livermore National Laboratory	\$ 148	\$ 0	\$ 140	>999
Los Alamos National Scientific Laboratory	\$ 275	\$ 246	\$ 298	+ 21
Mound Facility	\$ 75	\$ 67	\$ 99	+ 48
Oak Ridge Associated Universities	\$ 1,748	\$ 1,662	\$ 1,334	- 20
Oak Ridge National Laboratory	\$ 575	\$ 398	\$ 1,220	+207
Pacific Northwest Laboratory	\$ 158	\$ 198	\$ 511	+158
Savannah River Ecology Laboratory	\$ 100	\$ 88	\$ 99	+ 13
Savannah River Laboratory	\$ 75	\$ 67	\$ 99	+ 48

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1989	FY 1990	FY 1991
Laboratory Cooperative Science Centers			
Laboratory Cooperative Science Centers	Supports semester-length research appointments for 450 science/engineering undergraduate students at six laboratory science centers (ANL, BNL, LBL, ORNL, PNL and LANL) and 36 faculty/student research teams. Provides support for 2,000 summer faculty/student research appointments at 10 DOE laboratories. (\$9,342)	Similar faculty/student participant levels as in FY 1989. (\$10,058)	Slightly reduced levels as compared to FY 1990. (\$9,370)
			Consistent with the Secretary's commitment to more fully utilize the Department's lab resources in improving science education, support a variety of student and teacher/faculty research activities at Fermilab and support laboratory-university partnerships to undertake initiatives to increase minority student access to energy-related research careers. (\$800)
	Continues support for laboratory-based precollege science student and teacher programs including seven DOE high school science student honors research programs involving 364 nationally-selected students. Also provides support for 150 high school science teacher research appointments at ten DOE laboratories. (\$1,820)	Similar levels as in FY 1989. (\$1,818)	Similar levels as in FY 1990. (\$1,860)

III. Laboratory Cooperative Science Centers (Cont'd):

Program Activity	FY 1989	FY 1990	FY 1991
Laboratory Cooperative Science Centers (Cont'd)	No activity. (\$0)	No activity. (\$0)	<p>Support an increase in highest priority programs involving precollege science teacher research associate appointments and additional minority high school research apprenticeship appointments to encourage more students to stay in the math/science pipeline. Also support initiation of a cost-shared program to encourage more science/engineering students to pursue careers in precollege science/math teaching and provide support for related collaborative projects with other Federal agencies. These efforts are in keeping with the priorities established during the Secretary's Math/Science Education Action Conference. (\$1,250)</p> <p>Initiate inner city/rural partnerships designed to revitalize math/science in targeted school districts as called for at the Secretary's Math/Science Education Action Conference and in the recent Task Force report on Women, Minorities and the Handicapped. Implement Secretary's commitment to near-term actions in support of improved science education for minorities and other disadvantaged groups. Provide support for collaborative projects, among DOE laboratories, other Federal agencies, and the public and private sectors. (\$1,950)</p>

III. Laboratory Cooperative Science Centers (Cont'd):

Program Activity	FY 1989	FY 1990	FY 1991
Laboratory Cooperative Science Centers (Cont'd)	No activity. (\$0)	No activity. (\$0)	Initiate precollege mathematics science education program conducted at DOE labs. Provides support for summer research appointments for high school math teachers and summer institutes for middle school teachers on new concepts and techniques in math instruction. Also utilizes DOE laboratories as sites to introduce school district math coordinators to science/math in context of mission-oriented research. Provides support for cost-shared projects with NASA, and NSF in development of new advanced computer graphics for use in middle-school science and math classes. Initiative includes major emphasis on participation of inner-city math teachers. (\$2,000)
	No activity.	No activity.	Initiate museum-based science education program. Provides support for development of cost-shared museum science education exhibitions on major energy-related scientific programs. Exhibitions (including special precollege student/teacher materials) would travel to ten urban science museums over two year period reaching over one million adults, teachers and students. (\$1,000)
	\$ 11,162	\$ 11,876	\$ 18,230
Laboratory Cooperative Science Centers	\$ 11,162	\$ 11,876	\$ 18,230

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KEY ACTIVITY SUMMARY

UNIVERSITY AND SCIENCE EDUCATION

I. Preface: University Programs

Support is provided for science education and research-related efforts in areas of direct relevance to DOE where universities and colleges are the principal performers. Support is included for scientific and technical manpower development efforts, the collection and analysis of data on the supply and demand of scientists and engineers for current and future energy R&D programs, and the maintenance of a strong university research and manpower development base in nuclear science and engineering. Includes support for fabrication and shipping of fuel for university nuclear research reactors and continued support for the NRC-mandated conversion of selected university reactors to Low Enriched Uranium (LEU).

II. A. Summary Table: University Programs

Program Activity	FY 1989 Actual	FY 1990 Estimate	FY 1991 Request	% Change
University Programs.....	\$ 6,857	\$ 6,761	\$ 1,900	- 72
Total, University Programs	\$ 6,857	\$ 6,761	\$ 1,900	- 72

II. B. Major Laboratory and Facility Funding

Oak Ridge Associated Universities	\$ 392	\$ 388	\$ 390	+ 1
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III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1989	FY 1990	FY 1991
University Programs			
University Programs (Cont'd)	Provides support for university nuclear engineering research projects and for joint laboratory-university nuclear engineering education efforts. (\$5,929)	Continue nuclear engineering research program. (\$5,857)	No activity. (\$0)
	Continues analyses of manpower energy-related fields including assessment of needs for advanced degree professionals. (\$519)	Similar to FY 1989. (\$541)	Similar to FY 1990. (\$550)
	Supports 20 Prefreshman Engineering Projects reaching 2000 junior high school women and minority students. (\$409)	Similar ongoing activities as in FY 1989. (\$363)	Broadens focus of PREP to include all fields of science/math. Expands eligibility to include 6th grade students with repeat participation encouraged. Broadens focus of support provided for 33 awards, fully funded for two years at approximately \$20K per year. Enhanced program will reach 3000 women/minority students in FY 1991 and 6000 students in succeeding years. (\$1,350)
	\$ 6,857	\$ 6,761	\$ 1,900
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University Programs	\$ 6,857	\$ 6,761	\$ 1,900
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KEY ACTIVITY SUMMARY

UNIVERSITY AND SCIENCE EDUCATION

I. Preface: University Reactor Fuel Assistance

Provides support associated with the fabrication and shipping of nuclear fuel for university-based research/training reactors. The university-based nuclear research and manpower development effort is highly dependent on these specialized facilities, not only for nuclear related training, but also for research in the basic sciences. Support is provided through this program for the NRC-mandated conversion of university reactors to low enriched uranium fuel. This subprogram also includes support on a competitive basis for university reactor sharing grants which provide research and training opportunities for faculty/students from nearby universities and colleges without direct access to research reactors.

II. A. Summary Table: University Reactor Fuel Assistance

Program Activity	FY 1989 Actual	FY 1990 Estimate	FY 1991 Request	% Change
University Reactor Fuel Assistance.....	\$ 2,040	\$ 4,059	\$ 7,230	+ 78
Total, University Reactor Fuel Assistance	\$ 2,040	\$ 4,059	\$ 7,230	+ 78

II. B. Major Laboratory and Facility Funding

Argonne National Laboratory	\$ 200	\$ 196	\$ 50	- 74
Brookhaven National Laboratory	\$ 0	\$ 0	\$ 15	>999
Idaho National Engineering Laboratory - EG&G	\$ 1,618	\$ 1,604	\$ 1,599	0
Savannah River Laboratory	\$ 85	\$ 0	\$ 25	>999

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1989	FY 1990	FY 1991
University Reactor Fuel Assistance			
University Reactor Fuel Assistance	Provides refueling for 4 reactors (2 with LEU fuel) and funds 20 reactor sharing grants. Continues support for LEU conversion. (\$2,040)	Provides refueling for two reactors requiring HEU fuel (MIT and Missouri) and continues LEU conversion activities at four reactors (Virginia, Missouri-Rolla, Iowa State and Georgia Tech). Supports 20 reactor sharing grants. (\$2,233)	Provides continuing fuel support for University of Missouri and MIT and supports 20 reactor sharing grants. Supports LEU fuel fabrication for University of Michigan and Rhode Island reactors. (\$2,230)
	No activity. (\$0)	Support for upgrade university reactors and provide reactor facility at Arkansas Technical University as mandated by Congress. (\$1,826)	No activity. (\$0)
	No activity. (\$0)	No activity. (\$0)	Provide for program needs for uranium enrichment and fuel conversion costs. (\$5,000).
	\$ 2,040	\$ 4,059	\$ 7,230
University Reactor Fuel Assistance	\$ 2,040	\$ 4,059	\$ 7,230

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KEY ACTIVITY SUMMARY

UNIVERSITY AND SCIENCE EDUCATION

I. Preface: R&D Laboratory Technology Transfer

This Department-wide program aims at facilitating the effective spin-off of Federally supported technology from the laboratories, making the results of research and development available to the private sector for applications in the marketplace. Assignment of industry scientists at multiprogram and major single program laboratories and support of pilot technology transfer initiatives are integral components of this program. Consistent with the President's Executive Order on Facilitating Access to Science and Technology, the U.S., private and public sectors can broaden their technology base with new knowledge and opportunities from Federal laboratories.

II. A. Summary Table: R&D Laboratory Technology Transfer

Program Activity	FY 1989 Actual	FY 1990 Estimate	FY 1991 Request	% Change
R&D Laboratory Technology Transfer.....	\$ 1,385	\$ 2,219	\$ 2,400	+ 8
Total, R&D Laboratory Technology Transfer	\$ 1,385	\$ 2,219	\$ 2,400	+ 8

II. B. Major Laboratory and Facility Funding

Ames Laboratory	\$ 0	\$ 0	\$ 75	>999
Argonne National Laboratory	\$ 50	\$ 132	\$ 125	- 5
Brookhaven National Laboratory	\$ 0	\$ 29	\$ 125	+331
Fermi National Accelerator Laboratory	\$ 0	\$ 0	\$ 75	>999
Idaho National Engineering Laboratory - EG&G	\$ 0	\$ 0	\$ 125	>999
Lawrence Berkeley National Laboratory	\$ 0	\$ 155	\$ 125	- 19
Lawrence Livermore National Laboratory	\$ 0	\$ 29	\$ 125	+331
Los Alamos National Scientific Laboratory	\$ 0	\$ 0	\$ 125	>999
Oak Ridge National Laboratory	\$ 0	\$ 123	\$ 125	+ 2
Pacific Northwest Laboratory	\$ 137	\$ 82	\$ 125	+ 52
Sandia National Laboratories	\$ 0	\$ 0	\$ 125	>999
Solar Energy Research Institute	\$ 0	\$ 29	\$ 75	+159

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1989	FY 1990	FY 1991
R&D Laboratory Technology Transfer			
R&D Laboratory Technology Transfer	Increase number of industry-laboratory technology exchange assignments to 30, adding some targeted assignments in high temperature superconductivity pilot centers.	Fund 30 industry-laboratory technology exchange assignments at multiprogram and major single program laboratories.	Continue funding 30 industry-laboratory exchange assignments and emphasize 2-way exchanges. Initiate university-laboratory exchange assignments for technology transfer purposes.
	Pursue highly leveraged laboratory technology transfer initiatives including some in support of the high temperature superconductivity pilot centers with strong cost-sharing component. (\$1,385).	Fund additional highly leveraged laboratory technology transfer initiatives that have the prospect of broad applications in response to increased opportunities as laboratory technology transfer programs expand.	Continue centralized communication of laboratory opportunities and accomplishments, as mandated by P.L. 99-502 and perform planning for a data base of research in progress and laboratory capabilities.
		Provided support for program activities, including communication of DOE laboratory technology transfer accomplishments, as mandated by P.L. 99-502 (\$2,219).	Continue funding cost-shared laboratory technology transfer initiatives including the partnership concept with State economic development activities and jointly funded projects to bridge the gap between laboratory technology development and industry product enhancement needs. (\$2,400)
	\$ 1,385	\$ 2,219	\$ 2,400
R&D Laboratory Technology Transfer	\$ 1,385	\$ 2,219	\$ 2,400