DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT

OVERVIEW

BASIC ENERGY SCIENCES

The Basic Energy Sciences (BES) program supports basic scientific research that is crucial to achieving the goals of the Department of Energy and those described in the Energy Policy Act of 1992 and in the High Performance Computing Act of 1991 (Public Law 192-104). The main activities in BES are to conduct energy-related research, to design, construct and operate necessary scientific facilities for DOE and other users, and to support an information technology infrastructure for collaborative research. The research funded by the BES program utilizes the expertise of the national laboratories, universities, industry, and basic science for other government agencies.

SCIENCE FACILITIES UTILIZATION ENHANCEMENT: The Basic Energy Sciences request includes $60,000,000 to enhance the utilization of the Department's fundamental science and user facilities. This investment will significantly increase research time available to thousands of scientists in universities, Federal agencies, and U.S. companies. It will also leverage both Federally and privately sponsored research, consistent with the Administration's strategy for enhancing the U.S. National science investment. This increment is part of a $100 million science initiative to increase the utilization of the Department's large state-of-the-art science facilities. The proposed funding increases the number of users served in FY 1996 by several thousand over FY 1995 levels, and will significantly enhance the quality of service and availability of facility resources to users, including university and government scientists, as well as private companies who rely on unique BES facilities for their basic research needs. The proposed funding level will also result in a more rational and efficient utilization of such high technology facilities, which are generally oversubscribed by factors of two to three. Research communities that will benefit from this initiative include structural biology, materials sciences, superconductor technology, and medical research and technology development.

The following summary highlights the Basic Energy Sciences program encompassed within the FY 1996 request:

o The seven major user facilities would be operated at an enhanced level. The Manuel Lujan, Jr., Neutron Scattering Center (MLNSC) facility will operate with Defense Programs providing funds for Los Alamos Meson Physics Laboratory (LAMPF).

o The 6-7 GeV Synchrotron Radiation Source will continue to be constructed at Argonne National Laboratory (ANL).

o The High Performance Computing Research Centers, at Oak Ridge National Laboratory and Los Alamos National Laboratory, will both operate prototype computational systems providing support to approximately eight grand challenge class computational energy projects and the National Energy Research Supercomputer Center at Lawrence Livermore National Laboratory will begin work to transition a prototype massively parallel computing system into a production environment.

o The overall budget for Capital Equipment is increased to support the high priority needs of the program. The budget for General Plant Projects is increased to support high priority ES&H activities identified in the Department's Five Year Plan. The budget for Accelerator and Reactor Improvements and Modifications projects is increased to include upgrades of beamline instrumentation at NSLS, HFBR, HFIR, and ALS, and to provide for a new spallation target for the IPNS at ANL.

o Funding for the Combustion Research Facility, Phase II, initiated in FY 1987, is requested with project completion scheduled for FY 1999.

o Basic Energy Sciences will have an important role in three new initiatives: the PARTNERSHIP FOR NEW GENERATION VEHICLES (PNGV), ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS/SUSTAINABLE DEVELOPMENT, and SCIENCE FACILITIES UTILIZATION ENHANCEMENT.

o Provides for research and development and conceptual design activities for a spallation neutron source with the preferred alternative site being Oak Ridge National Laboratory.

The FY 1996 research program will emphasize SUSTAINABLE DEVELOPMENT. There is now general recognition that to achieve SUSTAINABLE DEVELOPMENT for products and processes for the future, protection of health and the environment will have to be incorporated from the beginning. In FY 1996, Basic Energy Sciences will start a new thrust in basic research to underpin development of new processes and products that take into account the complete lifecycle of things we make. Included will be basic research supporting the development of advanced batteries with long lives and less polluting materials; near-net-shape casting of metals and isostatic pressing of ceramics to eliminate grinding to size and thereby minimize the amount of hazardous waste particulate matter, catalysts for processes to improve the efficiency of fuels production and reductions in the emissions of pollutants from utilization; improved separation of wastes and their conversion into useful products; environmentally compatible biosynthetic components and processes; manufacturing processes with real-time automated monitoring, control and replacement systems; and improved geophysical characterization to better understand subsurface structure and fluids in reservoirs to guide exploration and predict contaminant flow.

Results from BES sponsored basic research become an integral part of the information base that underpins the Nation's energy technology development. The BES program strengthens the Nation's science and engineering foundation by training future scientists and providing improved environmental quality, better health and quality of life, economic competitiveness through the transfer of information and technology, energy self-sufficiency, and national security. The BES program is also at the forefront in the development of computational science as a new paradigm of research, complementing theory and experimentation. The research in the BES program is grouped into six major subprogram areas: Materials Sciences, Chemical Sciences, Engineering and Geosciences, Advanced Energy Projects, Energy Biosciences, and Applied Mathematical Sciences.

Much of the research sponsored by the BES program is driven by information needs that limit existing energy technologies. The link between basic research and applications, however, is typically not confined to any single energy or technological problem, but has applications to a number of technologies. For example, a new or improved heat transfer device may be applied to fossil, nuclear, solar or geothermal energy systems. Advances in high temperature superconducting materials also may be applied to a number of energy technologies, such as more efficient motors, generators, power transmission lines and transportation systems. These improvements will have tremendous economic and energy savings. Each of the subprograms in BES support research projects with similarly broad applications across a range of energy technologies. Whether attempting to burn coal cleaner or more cheaply, or to find ways to reduce the overall volume or hazards from wastes, nuclear or non-nuclear, solutions will ultimately depend on advances in basic research and the applications of those advances to energy technologies. The BES research program annually supports approximately 1,400 individual research projects at over 200 separate institutions, with direct support for over 4,000 investigators and 2,300 graduate students in the physical, biological, and mathematical sciences. These projects are selected on the basis of scientific excellence using peer review procedures, relevance to support of the DOE Strategic Plan, and their contribution to the goals of the Energy Policy Act of 1992.

Research is supported at national laboratories, universities and other institutions. Approximately one-fourth of BES funding supports university-based research directly. The list of universities receiving support covers almost every state and includes participation by both large and small institutions. All BES funded programs are rigorously peer-reviewed on a periodic basis. BES laboratory programs generally must minimally exploit one of three criteria: (1) complementary basic and applied research being supported at the same institution so as to maximize the likelihood of technology transfer; (2) multidisciplinary team expertise not ordinarily available within a university; or (3) the use of a large on-site National user facility. BES university grants tend to be oriented towards the training of young professionals for scientific and technological careers, and to be involved with forefront, cutting edge research. The facility component supports the operation of seven major user facilities. In addition, the FY 1996 facility request provides for the continuation of construction of an advanced x-ray radiation light source, the 6-7 GeV Synchrotron Radiation Source, at ANL. All activities related to the Advanced Neutron Source appear in a separate budget.

In addition to universities and national laboratories, BES supports research in and maintains ties with industry. Representatives from different industries serve on the BES Advisory Committee; experts from industry participate in the review of research proposals and use the specialized facilities sponsored by BES; industrial scientists participate in program advisory committees at the national laboratories; industry representatives are invited to attend BES conferences and workshops on special topics; and BES research programs are involved in over 500 collaborations with industries, including the automobile companies, energy companies, pharmaceutical companies, electronic companies, etc.

The BES program operates unique facilities that are available to a wide array of user groups. These major facilities account for a significant amount of the BES budget requirement. In general, facility costs have risen by an amount greater than the cost of living. These higher costs

can be attributed to higher utility costs, safety requirements, and higher user demands, as well as the cost of cutting-edge equipment. At the seven major user facilities funded by the BES program, the number of users is over 4,000 from industry, academia and federal laboratories in FY 1995. These facilities are the High Flux Beam Reactor (HFBR) and the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory, the Combustion Research Facility (CRF) at Sandia National Laboratories, Livermore, the High Flux Isotope Reactor (HFIR) and the Radiochemical Engineering Development Center (REDC) at Oak Ridge National Laboratory, the Stanford Synchrotron Radiation Laboratory (SSRL) at the Stanford Linear Accelerator Center, the Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory and the Advanced Light Source (ALS) at Lawrence Berkeley Laboratory.

These BES facilities support research conducted by a number of top U.S. universities and U.S. corporations (e.g., IBM, AT&T, Exxon, GM). These users sponsor major research teams in areas such as catalysis, electronics, polymers, and biomedicine. Results from these research efforts, including user facility based research funded in the Biological and Environmental Research program, are important not only to those institutions, but also to the Department. At the neutron sources, major companies and universities are doing research in structural biology and in superconductivity; research is also supported that evaluates radiative effects on materials important to fission, fusion, and radioactive waste technology. At the HFIR, important and unique isotopes are produced for scientific, medical and industrial use.

In order to make further progress in certain fields, more advanced facilities are required. One facility has been identified by the scientific community as being the most critical to the future needs of the Department's Basic Energy Sciences program: the 6-7 GeV Synchrotron Radiation Source, currently being constructed at the Argonne National Laboratory.

BES has as its principal goals:

- Focus of the research effort on: energy related activities identified in the DOE Strategic Plan with emphasis on the Science and Technology, Industrial Competitiveness, and Energy Resources business lines; and the Energy Policy Act of 1992; and on a multidisciplinary approach with participation of several subprograms, as appropriate.

- Completion of advanced scientific facilities for the Nation and safe and productive operation of the BES facilities.

- Demonstration of energy-related national challenge application in energy demand management for the National Information Infrastructure.

- Enhance the balanced approach to BES activities between research and facilities through growth in both areas where opportunities exist.

- Enhancement of math and science education - the BES program provides support for about 2,300 graduate students and 2,000 academic professors and post-doctoral researchers.

- Promote information and technology transfer.

The Department has developed performance measures for the results of its basic research activities. General performance measures of program outputs for basic research include such metrics as the number of scientists supported, the number of students earning advanced degrees, the number of scientific publications in peer-reviewed journals, the number of awards from professional organizations, and the number of citations in scientific publications. Metrics for the transfer of new knowledge to a technology application include the number of cooperative agreements with industry, the number of projects resulting in support from a DOE Energy Technology program, the number of invention records and patents, and the number of industry users at the major scientific user facilities. For construction projects, metrics can include costs and schedule milestones completed against approved project baselines. These performance measures are easily tabulated, commonly used, and begin to provide a framework for evaluating program efficiency. However, the most descriptive indicators in this area are qualitative rather than quantitative measures. In order to measure outcomes, or program effectiveness, the impact of the research outputs must be assessed in terms of the quality of the new knowledge gained, its usefulness to technology development, and its longer-term benefit to society. Although there are limited and expensive methods for evaluating the quality of science through peer-review metrics, no metric exists that can accurately measure science's impact on technology and society. The extent of industrial interest is a measure of the value of the research. BES has been involved in over 500 collaborations with industry. These collaborations extend over all sectors of the economy.

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative in whole dollars.)

LEAD TABLE

Basic Energy Sciences

Activity	FY 1994 Adjusted	FY 1995 Appropriation	FY 1995 Adjustment	FY 1995 Adjusted	FY 1996 Request
Operating Expenses					
Materials Sciences	$259,569	$275,721	-$3,402	$272,319	$348,297
Chemical Sciences	158,879	163,513	-3,935	159,578	181,565
Engineering and Geosciences	35,537	36,837	-992	35,845	39,953
Advanced Energy Projects	10,697	11,085	-274	10,811	12,026
Energy Biosciences	25,464	28,957	-1,021	27,936	29,534
Applied Mathematical Sciences	99,051	109,367	-1,251	108,116	108,688
Program Direction	9,120	9,900	0	9,900	10,000
Subtotal Operating Expenses	598,317	635,380	-10,875	624,505	730,063
Capital Equipment	43,544	41,537	-2,481	39,056	56,973
Construction	115,942	70,379	0	70,379	24,383
Subtotal Program	$757,803	$747,296	-$13,356	$733,940	$811,419
Adjustment	-14,213 a/	-8,839 a/	0	-8,839 a/	0
Total Program	$743,590 b/	$738,457	-$13,356	$725,101	$811,419

a/ Share of Energy Supply, Research and Development general reduction for use of prior year balances assigned to this program. The total general reduction is applied at the appropriation level.

b/ Excludes $8,784,000 which has been transferred to the SBIR program and $293,000 which has been transferred to the STTR program.

	FY 1994 Adjusted	FY 1995 Appropriation	FY 1995 Adjustment	FY 1995 Adjusted	FY 1996 Request
Summary					
Operating Expenses	$585,104	$631,200	-$10,875	$620,325	$730,063
Capital Equipment	42,544	40,678	-2,481	38,197	56,973
Construction	115,942	66,579	0	66,579	24,383
Total Program	$743,590	$738,457	-$13,356	$725,101	$811,419
Staffing (FTEs)					
Headquarters	71	77	0	77	78
Field	5	7	0	7	7
Total	76	84 c/	0	84	85

c/ Revised request.

Authorization: Section 209, P.L. 95-91, "Department of Energy Organization Act"

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

SUMMARY OF CHANGES

Basic Energy Sciences

FY 1995 Appropriation		$ 747,296
- Adjustment		- 13,356
FY 1995 Adjusted		$ 733,940
Operating Expenses		
- Increased funding is provided for the 6-7 GeV to continue advanced commissioning of the storage ring, the insertion devices and several beamlines leading to the initial operating phase of this facility	+	17,620
- Enhances operation of major user facilities (HFBR, HFIR, REDC, NSLS, CRF, IPNS, SSRL, ALS)	+	29,739
- The Manuel Lujan, Jr., Neutron Scattering Center operations will be restored. It is assumed that DOE Defense Programs will provide funds for LAMPF operations	+	6,970
- Continues support for the High Performance Computing and Communications program, including support of the National Information Infrastructure (NII) program. This budget reflects a one year shift of $2,000,000 from operating expenses to capital equipment to support the acquisition of a disk/archival mass storage system at NERSC	-	2,428
- Provides for research and development and conceptual design activities for a spallation neutron source with Oak Ridge National Laboratory as the preferred alternative site	+	8,000
- Increased support for research and instrumentation at major user facilities	+	13,557
- Program Direction funds provided for support of staff needed to monitor and manage program	+	100
- Support research relating to a new initiative on the PARTNERSHIP FOR NEW GENERATION VEHICLES	+	8,000

-	Support research relating to ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS/ SUSTAINABLE DEVELOPMENT	+ 24,000
	Capital Equipment	
-	Increased equipment funding associated with the 6-7 GeV Synchrotron Radiation Source construction project is provided, as detailed in the construction project data sheet	+ 3,358
-	Continues equipment needs associated with the High Performance Computing and Communications activities. This budget reflects a one year shift of $2,000,000 from operating expenses to capital equipment to support the acquisition of a disk/archival mass storage system at NERSC	+ 775
-	Additional beamlines will be provided at NSLS, SSRL, ALS, HFBR, and HFIR to meet the growing demand for x-rays and neutrons. Enhancements will be provided to the Ames Materials Preparation Center, the Illinois Center for Microanalysis of Materials, the ORNL shared instrumentation program, and electron microscopy centers at LBL and LLNL. Additional funds are also provided for peripheral and test equipment to support the operation of NERSC	+ 11,303
-	Increased equipment funding associated with research in the following subprograms: Materials Sciences, Chemical Sciences, Engineering and Geosciences, Advanced Energy Projects, and Energy Biosciences	+ 2,481
	Construction	
-	Complete construction of the 6-7 GeV Synchrotron Radiation Source	- 55,193
-	Increased funding for Accelerator and Reactor Improvements and Modifications projects to include upgrades of beamline instrumentation at NSLS, HFBR, HFIR, and ALS, and to provide for a new spallation target for the IPNS at ANL	+ 5,383
-	Increased funding for General Plant Projects to address the high priority needs of the program and to address high priority ES&H activities as identified in the Department's Five Year Plan	+ 1,814
-	Provides funding for the Combustion Research Facility, Phase II, initiated in FY 1987, with project completion scheduled for FY 1999	+ 2,000
FY 1996 Congressional Budget Request		$ 811,419

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Materials Sciences

The Materials Sciences subprogram supports fundamental scientific research into materials and their properties, and national user facilities that enable experiments to examine these materials. It creates knowledge necessary for removing scientific and technological barriers. Every technology is materials-limited and new materials can lead to new energy, automotive and environmental technologies and markets. The Materials Sciences subprogram addresses the materials needs for making the generation, conversion and conservation of energy more efficient, cost effective, safe, reliable, and environmentally acceptable.

Materials Science is an enabling technology. The performance parameters, economics, environmental acceptability and safety of all energy generation, conversion, transmission, and conservation technologies are limited by the performance of materials. This performance statement also pertains to automotive technologies, the safe and reliable transport, containment and storage of hazardous substances and the minimization of wastes in the synthesis and processing of commercial materials. Research in Materials Sciences is concerned with optimizing the behavior and performance of materials in these technologies. This research seeks to understand the synergistic relationship among the synthesis, processing, structure, properties, and behavior of a diverse range of materials in order to discover new technological capabilities. The subprogram supports efforts to find the optimal parameters for producing materials and accurately predicting their performance under conditions that will enable improvements in industrial technologies.

The basic research supported by the Materials Sciences subprogram seeks to understand the synergistic relationship between synthesis, processing, structure, properties of materials and development of new materials. One goal is to develop strategic, efficient, methods for the synthesis, processing, fabrication, quality manufacture and recycling of materials for technologically important applications.

Strong efforts are underway across the entire Materials Sciences subprogram in areas such as high-temperature superconductivity, solid electrolytes for batteries and fuel cells, corrosion resistance, mechanical behavior and failure resistance, photovoltaics, magnetic behavior, joining and welding, nanostructure materials, hard and wear resistant surfaces, engineered polymers, high-rate metal forming, and non-destructive evaluation. A common denominator to virtually all of these activities is the ultimate objective to improve the performance of materials under the operating conditions necessary for cost-effective performance that concurrently require increased factors of safety and minimization of health and environmental risk.

Research supported by Materials Sciences has led to 93 Cooperative Research and Development Agreements.

SUSTAINABLE DEVELOPMENT activities will take into account the total product lifecycle including synthesis, processing, fabrication, manufacture, and recycling of materials, with due consideration to waste minimization and containment, and quality manufacture, which will impact many strategic industries, such as the automotive industry, where materials is a critical enabling technology. Another SUSTAINABLE DEVELOPMENT thrust is on-line non-destructive evaluation of manufacturing processes with feed-back and instantaneous control of manufacturing parameters to provide total quality manufacturing assurance.

The Materials Sciences subprogram supports the operation of unique facilities that are not otherwise available to the scientific community which includes the private industrial sector, universities, and both DOE and other federal laboratories. In addition to users from the materials community, other users come from a broad range of disciplines including the chemical, biological, life sciences and geological communities. These facilities permit this broad spectrum of scientists to carry out investigations and procedures involving synchrotron radiation, neutron scattering, and electron beam microcharacterization. As long as the results of industrial research at DOE user facilities are made available to the scientific community and are of interest to DOE, there is no charge imposed on user groups for the use of these facilities. The construction

I. Materials Sciences (Cont'd)

and operation of these facilities are critical to national competitiveness. In 1993 there were 4,637 scientists (including 597 from 89 U. S. companies) who conducted X-ray and neutron beam experiments at user facilities supported by the Office of Basic Energy Sciences.

The Materials Sciences subprogram plays a lead role in representing Department of Energy programs in materials sciences to the National Science and Technology Council's Committee on Civilian Industrial Technology (NSTC/CIT) which coordinates materials R&D activities throughout the Federal government. This lead role consists of coordinating and integrating the input from approximately twenty different Department of Energy program offices to the NSTC/CIT. Within DOE, various materials science and technology programs are coordinated through the Energy Materials Coordinating Committee and its various topical subcommittees.

The Materials Sciences subprogram will have an important role in two initiatives: the PARTNERSHIP FOR NEW GENERATION VEHICLES (PNGV), and ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS.

Some examples of research accomplishments during the past year include the development of a new environmentally acceptable lead-free solder, development of an on-line system to prevent tearing during the forming of sheet metal, the development and commercialization of superconducting quantum interference devices that are able to detect small flaws in aircraft parts, the development of positron diagnostics to detect invisible weather damage in commercial polymer coatings, the development of a computer simulation technique to identify new commercial aluminum alloys and to design their commercial fabrication process parameters, the discovery of new rare-earth based alloys which improve the efficiency of magnetic refrigeration by about 30% and reduce the materials' cost by about 40%, the first complete identification of all of the major molecular forms of sulfur in coal by means of synchrotron X-ray probes, the development of an advanced method of synchrotron X-ray lithographic fabrication of computer chips with higher resolution and greater density than those made with conventional X-ray processing, discovery of a new and important catalyst formed from a molybdenum-sulfur cluster in a zeolite cage, development of a lithium thin film battery with unprecedented performance parameters that is now being commercialized, the development of commercial ion beam processing technology for orthopedic materials, the first-time production of large ingots of metallic glass, the development of a thermoacoustic refrigerator that does not use freon or any other environmental pollutant, the development of new commercial polymer blend products by means of small-angle neutron scattering, the development of a three-dimensional simulation model for predicting the shape of a weld pool for a single-pass weld, the development of a new class of highly efficient semiconductor lasers, a world record high efficiency solar cell, a significant advancement in the understanding of the mechanism of sulfur induced corrosion of steel, the solution of the brittleness problem in a newly discovered whisker reinforced structural ceramic, and development of a new method of forming aluminum layers with strengths comparable to high strength steels.

II. A. Summary Table: Materials Sciences

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Materials Sciences Research	$ 135,777	$ 138,365	$ 169,571	$ 31,206
Facilities Operations	123,792	133,954	178,726	44,772
Total, Materials Sciences	$ 259,569	$ 272,319	$ 348,297	$ 75,978

II. B. Laboratory and Facility Funding Table: Materials Sciences

	FY 1994 Adjusted	FY 1995 Estimate	FY 1996 Request	$ Change
Ames Lab	$ 9,637	$ 9,182	$ 9,790	$ 608
Argonne National Lab (East)	76,214	88,189	111,208	23,019
Brookhaven National Lab	48,662	47,920	54,804	6,884
Idaho National Engineering Lab	404	415	518	103
Lawrence Berkeley Lab	37,786	36,126	46,333	10,207
Lawrence Livermore National Lab	2,361	2,585	2,760	175
Los Alamos National Laboratory	8,909	6,834	13,929	7,095
Oak Ridge National Lab	22,342	21,478	30,674	9,196
Pacific Northwest Lab	3,423	3,374	3,565	191
Sandia National Laboratories	8,230	7,867	8,099	232
All Other	41,601	48,349	66,617	18,268
Total, Materials Sciences	$ 259,569	$ 272,319	$ 348,297	$ 75,978

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

Program Activity	FY 1994	FY 1995	FY 1996
Materials Sciences			
Materials Sciences Research	Metallurgy and Ceramics Research - Continued effort on understanding synthesis-processing-structure-property relationships in ceramic superconductors. Increased thrusts in safety and reliable performance of materials. Continued efforts on corrosion resistant materials, surface modification to improve friction and wear, modelling of near-net shape fabrication processes for complex materials systems, welding and joining of metallic and ceramic materials, materials for radiation environments, synthesis and processing of photovoltaic materials, and high temperature structural ceramics.	Metallurgy and Ceramics Research - Continue effort on understanding synthesis-processing-structure-property relationships in ceramic superconductors. Sustain thrusts in safety and reliable performance of materials. Continue efforts on surface modification to improve friction and wear, modelling of near-net shape fabrication processes for complex materials systems, welding and joining of metallic and ceramic materials, materials for radiation environments, synthesis, processing and behavior of photovoltaic materials, and high temperature structural ceramic composites. Increased thrusts of synthesis and processing of metals and ceramics, aqueous corrosion, and high-temperature gaseous corrosion and erosion.	Metallurgy and Ceramics Research - Continue effort on understanding synergistic relationship between synthesis-processing-structure-properties, behavior, performance and recycling of metals and ceramics for strategic energy, environmental, and automotive needs. Sustain thrusts in safety and reliable performance of materials. Continue efforts on surface modification to improve friction and wear, modelling of near-net shape fabrication processes for complex materials systems, welding and joining of metallic and ceramic materials, materials for radiation environments, synthesis, processing and behavior of solar photovoltaics, and high temperature structural ceramic composites. Continue efforts in aqueous corrosion, and high temperature gaseous corrosion and erosion.

III. Materials Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Materials Sciences Research (Cont'd)			Initiate effort on on-line non-destructive evaluation monitoring of manufacturing processes. Increased support for instrumentation and research at major user facilities.
	Solid State Physics Research - Continuation of high priority research within the DOE mission especially in neutron scattering and synchrotron light sources. Continued efforts in the physics of high-temperature superconductivity, radiation effects, and the development of novel characterization methods. Continued efforts on the physics of surfaces and interfaces. Enhanced emphasis on new materials with energy-related properties. Enhanced emphasis in magnetic and photovoltaic materials. Enhanced effort to develop beamlines for the Advanced Light Source (ALS) and the 6-7 GeV Synchrotron Radiation Source (6-7 GeV).	Solid State Physics Research - Continuation of high priority research within the DOE mission especially in neutron scattering and synchrotron light sources. Continued efforts in the physics of high-temperature superconductivity and radiation effects at the same level, and the development of novel characterization methods. Continued efforts on the physics of surfaces and interfaces. Continued emphasis on new materials with energy-related properties. Continued emphasis on thrusts in magnetic and photovoltaic thin film materials. Continued emphasis on beamline development.	Solid State Physics Research - Continuation of high priority research within the DOE mission especially in neutron scattering and synchrotron light sources. Continued efforts in the physics of high-temperature superconductivity, the physics of surfaces and interfaces, and development of novel characterization methods. Continued emphasis on new materials with energy-related properties. Continued emphasis on the development of beamlines for ALS and the 6-7 GeV. Enhanced emphasis in magnetism, and magnetic, photonic and photovoltaic materials. Increased support for instrumentation and research at major user facilities.
	No activity.	No activity.	Provides $8 million for R&D and conceptual design activities for a spallation neutron source. The preferred alternative site for the spallation source would be Oak Ridge National Laboratory, to maximize the use of neutron source design expertise already developed through the preparation of the ANS conceptual design, and to take advantage of the laboratory's experience in operating particle accelerators and conducting neutron scattering research. The spallation source research and development effort will make use of the best capabilities in the DOE laboratories, including the Defense Programs' Accelerator Production of Tritium (APT) project at Los Alamos

III. Materials Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Materials Sciences Research (Cont'd)			National Laboratory. Without a major new neutron source or upgraded operation of an existing research reactor, the United States will forego significant scientific, technical, and economic benefits that derive from neutron scattering and materials irradiation research and the production of medical isotopes. A spallation neutron source should enable the Nation to carry out major research activities in areas such as biology, materials science, superconductivity, pharmaceuticals, electronic materials, and many other technological areas that are critical for future U.S. economic competitiveness and national security.
	Materials Chemistry Research - Continued emphasis on research including synthesis and characterization of novel organic and inorganic superconductors and magnetic materials, synthetic metals, surfaces and interfaces, polymers and materials synthesized by biological processes. New programs have been developed in the synthesis of biomolecular materials, novel ferromagnets, superconductors, and synthetic metals. There was an enhanced effort to provide beamline support for the ALS and 6-7 GeV.	Materials Chemistry Research - Continued emphasis on research including synthesis and characterization of nanoscale materials based on novel cluster chemistry, organic ferromagnets, novel organic/inorganic superconductors, synthetic metals, surface chemistry of interfaces, polymers and materials synthesized by biological processes. Continued emphasis on understanding friction, lubrication, and corrosion. Programs will be developed in the synthesis of biomolecular materials, novel ferromagnets, and synthetic metals. Continued effort to support beamlines at neutron and synchrotron light sources.	Materials Chemistry Research - Continued emphasis on research including synthesis, processing, and characterization of polymers, organic ferromagnets, fullerene derivatives, nanocluster materials, organic and inorganic superconductors. Emphasis will be continued in surface chemistry including corrosion, electrochemistry, the molecular understanding and control of lubrication and friction, new oxides, nitrides, and sulfides, biomolecular materials and neutron, X-ray , and NMR characterization of organic materials. New emphasis will be given to polymer composites and nanostructural materials. Continued beamline development. Increased support for instrumentation and research at major user facilities.

III. Materials Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Materials Sciences Research (Cont'd)	No activity.	No activity.	The PARTNERSHIP FOR NEW GENERATION VEHICLES encompasses four research areas in Materials Sciences: Advanced manufacturing including investigations into the solidification, casting and welding of recyclable light-weight alloys; high-rate plastic and super-plastic forming of light-weight sheet metal; on-line control of processing and manufacturing parameters for total quality manufacturing; synthesis and processing of light-weight high-strength polymers, polymer matrix composities, and wear-resistant light-weight structural ceramics and composites. Reduction of mechanical losses including stress fatigue and service lifetime in recyclable metals, intermetallics, and structural ceramics; deformation and fracture (crash resistance). Light-weight materials including corrosion of recyclable light-weight metals, metal matrix composites; high magnetic strength energy efficient magnetic materials. Energy conversion and storage including sensors and catalysts; solid electrolytes for batteries and development of light-weight batteries and fuel cells.
	No activity.	No activity.	ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS includes two Materials Sciences research categories: Waste minimization in the synthesis and processing of materials includes environmentally benign synthesis routes for polymers, ceramics and semiconductors; near net shape forming processes for ceramics and metals to minimize or eliminate grinding wastes; and less toxic procedures and filler materials for welding, soldering, and brazing. Safety and reliable containment of hazardous wastes

III. Materials Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Materials Sciences Research (Cont'd)			Includes research on fracture toughness and crash resistance and corrosion prevention of welded containers; development of remote, non-destructive diagnostics for the detection and analysis of trace quantities of hazardous substances.
	EPACT: EPACT Section 2201 "National Advanced Materials Initiative:" The Basic Energy Sciences program conducted research related to the goals of EPACT in the area of advanced materials. INVESTMENT: Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package. Funding in the amount of $3,870,000 and $129,000 has been transferred to the SBIR program and the STTR program, respectively.	EPACT: EPACT Section 2201 "National Advanced Materials Initiative:" The Basic Energy Sciences program conducts research related to the goals of EPACT in the area of advanced materials. INVESTMENT: Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package. Funding in the amount of $5,408,000 and $270,000 has been budgeted for the SBIR program and the STTR program, respectively.	EPACT: EPACT Section 2201 "National Advanced Materials Initiative:" The Basic Energy Sciences program conducts research related to the goals of EPACT in the area of advanced materials. INVESTMENT: Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package. Funding in the amount of $6,966,000 and $522,500 has been budgeted for the SBIR program and the STTR program, respectively.
	$ 135,777	$ 138,365	$ 169,571

III. Materials Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Facilities Operations	Continued support for major facilities in the Materials Sciences subprogram with increased funding for first full year of operation for the Advanced Light Source (LBL). Provided increases needed for R&D and commissioning of components of the 6-7 GeV Synchrotron Radiation Source (ANL). Began workshops and meetings leading to a conceptual design of a pulsed spallation neutron source. (For more detail on Facilities Operations see the Major User Facilities section following the Construction section.)	Continues support for major facilities in the Materials Sciences subprogram. Provides increases needed for R&D and commissioning of components of the 6-7 GeV Synchrotron Radiation Source (ANL). (For more detail on Facilities Operations see the Major User Facilities section following the Construction section.)	Enhanced support for major user facilities in the Materials Sciences subprogram. Provides increases needed for final commissioning of the 6-7 GeV Synchrotron Radiation Source (ANL). Restores operation of Manuel Lujan, Jr., Neutron Scattering Center. (For more detail on Facilities Operations see the Major User Facilities section following the Construction section).
	EPACT:	EPACT:	EPACT:
	EPACT Section 2203(a)(2)(a) "Supporting Research and Technical Analysis:"	EPACT Section 2203(a)(2)(a) "Supporting Research and Technical Analysis":	EPACT Section 2203(a)(2)(a) "Supporting Research and Technical Analysis":
	Provided funds for operation of user facilities to provide special scientific and research capabilities to serve the research needs of the Nation's universities, industry, private laboratories, federal laboratories, and others.	Provides funds for operation of user facilities to provide special scientific and research capabilities to serve the research needs of the Nation's universities, industry, private laboratories, Federal laboratories, and others.	Provides funds for operation of user facilities to provide special scientific and research capabilities to serve the research needs of the Nation's universities, industry, private laboratories, Federal laboratories, and others.
	INVESTMENT:	INVESTMENT:	INVESTMENT:
	Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1996 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.
	$ 123,792	$ 133,954	$ 178,726
Materials Sciences	$ 259,569	$ 272,319	$ 348,297

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Chemical Sciences

The Chemical Sciences subprogram supports a broad range of basic research in molecular, atomic and chemical engineering sciences necessary for improvements in existing energy technologies and development of new energy technologies. Major chemical sciences research efforts are important to more efficient conversion of solar energy to fuels or electricity; improved combustion processes; better utilization of carbonaceous resources, including natural gas, oil, coal and biomass; new and better approaches to environmental management; more efficient catalytic processes for producing fuels and chemicals; more sensitive and specific monitoring of physical and chemical processes; and the advancement of fission and fusion concepts. The subprogram is divided into activities which are described below. In addition, Chemical Sciences provides support for major scientific user facilities which are operated for the benefit of the entire U. S. scientific community.

Recent examples of research results that may have significant technological impact may be cited. A new catalyst for the conversion of methane, the principal component of natural gas, to methanol, a transportable liquid fuel, has now been pilot plant tested and a demonstration plant is being built. Two new synthesis techniques, based on super critical fluids and reverse micelles, have been developed for producing nanophase particles. Nanophase particles are used to generate extremely active coal liquefaction catalysts utilized by the Office of Fossil Energy. They hold promise for synthesis of nanometer-sized catalysts, semiconductors and non-linear optical materials. In a spin-off of research on electron-atom scattering, a laser based technique for preparing a surface layer less than two hundred nanometers in size on a substrate using atom optics was developed. A grating-like pattern can be formed that is as small as the best that can be produced by current lithography technology. A collaborative effort between industry and a national laboratory has lead to the design of two new burners which reduce emissions of oxides of nitrogen by 85% or more. Research in combustion diagnostics led to a laser-based detection system, being developed by industry, for integration with capillary electrophoresis and high performance liquid chromatography in analytical instrumentation for DNA sequencing.

The Chemical Sciences subprogram will have an important role in two initiatives: the PARTNERSHIP FOR NEW GENERATION VEHICLES (PNGV) and the ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS.

II. A. Summary Table: Chemical Sciences

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Chemical Sciences Research	$ 104,083	$ 105,821	$ 118,251	$ 12,430
Facilities Operations	54,796	53,757	63,314	9,557
Total, Chemical Sciences	$ 158,879	$ 159,578	$ 181,565	$ 21,987

II. B. Laboratory and Facility Funding Table: Chemical Sciences

	FY 1994 Adjusted	FY 1995 Estimate	FY 1996 Request	$ Change
Ames Lab	$ 3,796	$ 3,539	$ 3,539	$ 0
Argonne National Lab (East)	15,978	15,561	15,561	0
Brookhaven National Lab	17,163	16,784	18,140	1,356
Idaho National Engineering Lab	306	306	306	0
Lawrence Berkeley Lab	8,676	7,435	7,761	326
Los Alamos National Laboratory	1,001	971	971	0
Oak Ridge National Lab	43,410	41,496	45,807	4,311
Pacific Northwest Lab	6,392	6,392	6,392	0
Sandia National Laboratories	7,823	7,130	7,876	746
All Other	54,334	59,964	75,212	15,248
Total, Chemical Sciences	$ 158,879	$ 159,578	$ 181,565	$ 21,987

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

Program Activity	FY 1994	FY 1995	FY 1996
Chemical Sciences			
Chemical Sciences Research	Photochemistry Research - Research continued to focus on solvent dynamics, electron transfer, and short-lived phenomena. Progress in these technical areas is necessary for more efficient conversion of solar energy into other useful energy forms. Also necessary to achieve these long term goals is planned research on dye-sensitized semiconductor photoelectrodes, heterogeneous photocatalysis, and new organometallic precursors for electronic materials.	Photochemistry Research - Support for research that will enhance molecular level understanding related to solar photochemical energy conversion will be maintained. Increased emphasis will be placed upon novel semiconductor structures as well as organic semiconducting and electrically conducting polymers of import to solar photochemical energy conversion.	Photochemistry Research - The primary goal of the photochemistry program is to support basic research that will lead to improved devices for the conversion of solar radiant energy into electricity or fuels. Areas of research emphasis that contribute to this goal include the study of how natural systems, such as plants, convert solar radiant energy into high energy content materials and chemicals, and the characteristics of novel photovoltaic systems that are capable of converting radiant solar energy into electricity with reasonable efficiency. The results from this area of research are directly tied to development of sustainable technologies based on solar and renewable energy sources. The radiation sciences research program has and continues to be invaluable for understanding how and what is occurring in complex radiation environments like

III. Chemical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Chemical Sciences Research (Cont'd)			those encountered in waste tanks at Hanford and elsewhere. In general, this research has and will continue to lead to better ways to predict the health and environmental effects of ionizing radiation. Increased support for instrumentation and research at major user facilities.
	Chemical Physics - Critical to the Energy Policy Act of 1992 is an understanding, on the molecular level, of combustion processes. Funding levels permitted high priority programs in chemical dynamics and kinetics of simple reactions including the reaction dynamics of hot molecules and surface combustion chemistry to continue. The CRF continued as a major site devoted to a broad program in combustion related chemical physics. Cluster research, a new area of molecular science, continued because it had potential for improved understanding of catalysis and the behavior of materials. Interaction with the technology programs related to combustion and environmental restoration was continued.	Chemical Physics - The majority of the nation's energy arises from combustion and research related to combustion continues as a high priority program within the Chemical Sciences subprogram. Research related to chemical dynamics and kinetics of simple reactions of combustion interest will continue with high priority. Research of lower priority will be reduced in favor of combustion related work so as to maintain the strength and viability of the DOE combustion research effort. Emphasis will be placed on theoretical and experimental characterization of clusters, a unique form of matter, as a function of their composition, size, structure, and bonding.	Chemical Physics - Chemical physics research will focus on combustion and catalysis related research. Combustion processes account for about ninety percent of the energy generated today. In order to reduce the environmental effects of combustion processes they must be made more efficient, less polluting, and therefore, more sustainable. Catalysts are essential to improving the selectivity and efficiency of a whole host of processes for energy conversion and storage including the production of high energy content materials such as gasoline and other fuels. Research will focus on developing a better understanding of the chemistry of catalytic systems. Discovery of new catalysts may determine if existing processes are sustainable and enable development of sustainable methods for utilizing existing resources. Increased support for instrumentation and research at major user facilities.

III. Chemical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Chemical Sciences Research (Cont'd)	Atomic Physics - The budget request was consistent with the report on "Future Research Opportunities in Atomic, Molecular, and Optical Physics" and the program provided support for efforts consonant with those areas listed. Specifically, approaches to the study of high energy density systems and energy-loss processes were emphasized. Experimental and theoretical efforts in multi-electron excitation and ionization improved understanding of the fusion process, light-matter interactions, and collision phenomena. Programs in atomic and plasma physics for advanced energy concepts related to many industrial and consumer needs were included. The plasma physics activity was coordinated with Energy Research's Fusion Energy program. An area of emphasis was on accurate characterization of chemical processes taking place in plasmas including surface phenomena and interactions between complex species found in plasmas.	Atomic Physics - Research consistent with the report "Future Research Opportunities in Atomic, Molecular, and Optical Physics" will be maintained. A new emphasis will be in the area of low-temperature plasma physics which have the potential of significant impact on materials processing.	Atomic Physics - Physics research on plasmas and energetic species associated with plasmas, including highly ionized heavy atoms, important to the advancement of fusion concepts will be emphasized. Increased support for instrumentation and research at major user facilities.
	Chemical Energy - The catalysis research included work on oxide and photoelectric catalysis, modification of shape selective oxide catalysts, and work to extend the conversion of paraffinic hydrocarbons to chemicals with significant energy efficiency, which included work with renewable feedstocks. This activity was coordinated with other more applied catalysis programs in DOE through ongoing discussions.	Chemical Energy - All program elements will continue. Synthetic and mechanistic chemistry of novel inorganic and organometallic precursors to advanced materials, which are important to new ceramics, catalysts, semiconductors and other technologically important materials, will be enhanced. In addition, nanoscale synthesis of particles (quantum dots) and surface clusters, which may lead to new photovoltaic materials and new catalysts for the control of reactions important to alternative fuels and industrial chemicals, will be undertaken.	Chemical Energy - The two main efforts under this program are the catalysis related research program and chemistry important to development of better ways to utilize carbonaceous resources such as natural gas, oil, coal and biomass. Research in catalysis is carried out on homogeneous and heterogeneous systems. As with the chemical physics program, this research seeks to better understand the effect of metals that are the basis for most catalysts that are commercially important. Increased support for instrumentation and research at major user facilities.

III. Chemical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Chemical Sciences Research (Cont'd)	Chemical Engineering - In chemical engineering sciences, research on combustion related turbulence and phase equilibria of complex mixtures, experimental and theoretical, and physically based predictive models was protected. The basic research program on advanced batteries was expanded to include research on aspects of fuel cells. This research was coordinated with other appropriate applied program elements in DOE.	Chemical Engineering - In chemical engineering sciences, research on the theoretical modeling of phase equilibria and thermophysical properties related to efficient processing will be strengthened, including modeling of turbulent flames related to reduction of environment pollutants in combustion processes. The advanced battery research program will continue at the FY 1994 level.	Chemical Engineering - Research in this area seeks to provide better and more physically realistic models for predicting the thermophysical properties and physical equilibrium of complex fluid mixtures and properties of turbulent combustion systems. The advanced battery research activity supported under this program is on batteries for non-automotive applications. It is well coordinated with the much larger and more applied effort supported by the Office of Energy Efficiency and Renewable Energy through the Advanced Battery Consortium. Increased support for instrumentation and research at major user facilities.
	Analytical Chemistry - Actinide separations research needed to underpin the development of new processes for dealing with environmental and hazardous wastes continued. Biotechnology related analytical research on macromolecules was protected.	Analytical Chemistry - The chemical properties and structure of interfaces, as determined by laser ablation, atomic force microscopy and molecular imaging of ceramic and other inorganic materials, important to the development of new and improved analytical methods and separation techniques will be emphasized.	Analytical Chemistry - This program is particularly important to processes being developed for remediation of contaminated environmental systems and waste. Emphasis in separations science will be on more efficient separations processes based on selective membranes and design of molecular systems for species-specific separations. Analytical chemistry research will focus on analytical methods that are more sensitive and species specific. The interaction between the separations science research program and DOE's Environmental Restoration and Waste Management Efficient Separations Program is one example of the importance of this program to environmental management programs. Just as improvements in many existing processes owe their development to innovations made possible by research results from this program, SUSTAINABLE DEVELOPMENT will depend in key ways on this program. Increased support for

III. Chemical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Chemical Sciences Research (Cont'd)			Instrumentation and research at major user facilities.
	Heavy Element Chemistry - Emphasis was on solid state heavy element chemistry related to superconducting materials, environmental and hazardous waste related activities and lanthanide chemistry.	Heavy Element Chemistry - In the heavy element chemistry program, the study of the effect of f-electrons in superconducting materials, including the effects of magnetic fields on superconducting electrons, important to understanding superconductivity in actinide and lanthanide mixed metal oxides will be enhanced as will research on actinide chemistry in near neutral solutions since it is important to improved understanding of actinide transport under environmental conditions.	Heavy Element Chemistry - Research will focus on development of better ways to deal with radioactive materials with emphasis on understanding the chemical behavior and migration of actinide elements under environmental conditions and discovering better ways to remove them from contaminated environmental sites or radioactive wastes. Increased support for instrumentation and research at major user facilities.
	No activity.	No activity.	PARTNERSHIP FOR NEW GENERATION VEHICLES (PNGV) - A major goal of the PNGV is the design of new internal combustion engines with improved efficiencies and reduced emissions. This requires better combustion models. The main stumbling block is coupling combustion chemistry with fluid dynamics. Experimental and theoretical research in chemical physics on mechanisms and dynamics of combustion reactions coupled with research on turbulent combustion systems under chemical engineering sciences will address this need. In addition, catalysis research aimed at improving the removal of oxides of nitrogen from the exhaust of lean burn engines will be carried out under the chemical energy program.

III. Chemical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Chemical Sciences Research (Cont'd)	No activity.	No activity.	ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS - Research to be carried out under the ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS will be related to technologies in the areas of avoidance or prevention, remediation and monitoring and assessment. Research in solar photoconversion will underpin development of more practical devices. The research on advanced batteries for non-automotive applications is closely related to both this effort and fuel cells related research. All contribute to technologies that would avoid production of environmentally hazardous substances. Catalysis research is broadly applicable to both avoidance and remediation technologies. It will impact energy intensive industries, particularly petroleum refining and chemical and allied products. Separations and actinide chemistry are essential to development of remediation technologies for remediation of radioactive wastes. Research in analytical chemistry has and will continue to result in novel technologies for monitoring and assessment.
	INVESTMENT:	INVESTMENT:	INVESTMENT:
	Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.
	Funding in the amount of $2,374,000 and $79,000 has been transferred to the SBIR program and the STTR program, respectively.	Funding in the amount of $3,149,000 and $157,500 has been budgeted for the SBIR program and the STTR program, respectively.	Funding in the amount of $3,631,000 and $272,000 has been budgeted for the SBIR program and the STTR program, respectively.
	$ 104,083	$ 105,821	$ 118,251

III. Chemical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Facilities Operations	Support was provided to major user facilities which are available to the entire scientific community. The facilities continued to operate at the level set in FY 1993 adjusted for inflation. Improvements in safety, management, and operations at the facilities were continued. Increasing requirements in quality assurance and conduct of operations were addressed to the extent possible. (For more detail on Facilities Operations see the Major User Facilities section following the Construction section). **EPACT:** EPACT Section 2203(a)(2(a) "Supporting Research and Technical Analysis": Provided funds for operation of user facilities to provide special scientific and research capabilities to serve the research needs of the Nation's universities, industry, private laboratories, Federal laboratories, and others. **INVESTMENT:** Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Support is provided to major user facilities which are available to the entire scientific community. The facilities will continue to operate at approximately the level set in FY 1994. Improvements in safety, management, and operations at the facilities will be continued. Increasing requirements in quality assurance and conduct of operations will be addressed to the extent possible. (For more detail on Facilities Operations see the Major User Facilities section following the Construction section). **EPACT:** EPACT Section 2203(a)(2)(a) "Supporting Research and Technical Analysis": Provides funds for operation of user facilities to provide special scientific and research capabilities to serve the research needs of the Nation's universities, industry, private laboratories, Federal laboratories, and others. **INVESTMENT:** Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Enhanced support is provided to major user facilities which are available to the entire scientific community. Improvements in safety, management, and operations at the facilities will be continued. Increasing requirements in quality assurance and conduct of operations will be addressed to the extent possible. (For more detail on Facilities Operations see the Major User Facilities section following the Construction section). **EPACT:** EPACT Section 2203(a)(2)(a) "Supporting Research and Technical Analysis": Provides funds for operation of user facilities to provide special scientific and research capabilities to serve the research needs of the Nation's universities, industry, private laboratories, Federal laboratories, and others. **INVESTMENT:** Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.
	$ 54,796	$ 53,757	$ 63,314
Chemical Sciences	$ 158,879	$ 159,578	$ 181,565

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Engineering and Geosciences

This subprogram is responsible for the support of DOE's principal strategic research activities in the engineering and geosciences disciplines at DOE laboratories and the Nation's academic institutions which support the full spectrum of DOE missions. The research contributes to the scientific underpinning for the technology pipeline leading to SUSTAINABLE DEVELOPMENT. The areas of particular concern are: pollution avoidance, control, and remediation; increased energy efficiency; and assuring future energy supplies. Research outcomes include improved manufacturing, increased reserves of domestic natural gas and oil, improved environmental remediation, lower cost of energy production and distribution, and the addition of new highly skilled personnel to the Nation's work force. These deliverables all contribute to the foundation for a sustainable economy which is wise use of resources. The subprogram emphasizes research activities by individual investigators and small interdisciplinary teams at the national laboratories and Universities. An increasing fraction of the effort in this subprogram features joint research projects involving partnerships between National Laboratories, universities and industry, making the resources of the Government more productive and more responsive to its citizens and businesses. This subprogram will have an important role in the new initiative on ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS.

Engineering research serves as a conduit between basic science and applications-oriented research and development with the goals of maintaining leadership in engineering and stimulating sustainable job growth while protecting the environment. The engineering activity aims are (1) to improve and advance our knowledge of processes underlying current engineering practice, and (2) to expand the store of fundamental concepts for solving anticipated and unforeseen engineering problems in energy technologies. Peer-reviewed topics addressed include fundamentals important to increasing energy efficiency, to identifying potential sustainable new energy production and utilization processes, to advanced manufacturing science, and to maintaining high environmental standards. Examples include multiphase flows (important to energy production and to waste management), instrumentation and control systems (important to intelligent systems for material processing and synthesis of high quality manufactured products, and for bioprocessing of fuels and energy-related wastes), and issues such as reliability and useful life prediction of aging energy production and distribution systems (important for economy, safety and environmental considerations). Recent activities emphasize increasingly the investment in human resources.

Geosciences research provides the foundation for environmentally sound, efficient, and economic use of the Earth's energy resources. It also provides the scientific basis for improved and innovative environmental remediation technologies. The Geosciences goals are to: (1) develop new data and concepts to improve our predictive understanding of natural processes which control the origin and distribution of energy-related resources, and (2) incorporate these data and concepts into a framework for anticipation of the impact of human endeavors on natural processes and the environment. Programmatic emphasis is on natural and contaminated fluids flowing in, and interacting with, porous and fractured geologic media. Underlying principles and phenomena are of broad and general applicability to: geologic disposal of radioactive and hazardous waste; geothermal energy utilization; improved recovery of oil and gas; remedial action at contaminated sites; and in situ processing of coal and oil shale resources. The theme of common processes in natural and anthropogenic phenomena, though active over quite disparate spatial and temporal scales, provides a sound foundation for the development and implementation of energy and environmental policies.

II. A. Summary Table: Engineering and Geosciences

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Engineering Research	$ 16,214	$ 16,422	$ 18,402	$ 1,980
Geosciences Research	19,323	19,423	21,551	2,128
Total, Engineering and Geosciences	$ 35,537	$ 35,845	$ 39,953	$ 4,108

II. B. Laboratory and Facility Funding Table: Engineering and Geosciences

Argonne National Lab (East)	793	570	575	5
Brookhaven National Lab	363	425	420	-5
Idaho National Engineering Lab	2,301	1,707	1,978	271
Lawrence Berkeley Lab	2,381	1,741	1,275	-466
Lawrence Livermore National Lab	1,743	1,221	850	-371
Los Alamos National Laboratory	1,990	1,300	1,025	-275
Oak Ridge National Lab	2,625	1,885	2,250	365
Pacific Northwest Lab	768	646	600	-46
Sandia National Laboratories	1,900	1,385	1,000	-385
All Other	20,673	24,965	29,980	5,015
Total, Engineering and Geosciences	$ 35,537	$ 35,845	$ 39,953	$ 4,108

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

Program Activity	FY 1994	FY 1995	FY 1996
Engineering and Geosciences			
Engineering Research	Studies of aging and its mitigation in energy related structures continued, with special attention being paid to a better understanding of the effects of advanced materials processing on the eventual mechanical properties and performance of the structural components. A statistical model of sea-wave induced motion of offshore structures has been developed for use in fatigue and aging studies. Those studies include the application of advances in the theories of dynamical systems to modeling the aging of structures. The search for simplified, but realistic models of complex processes such as fluid-flow induced vibrations in heat exchangers and chemically driven pattern formation continued. Conditions for maintaining the stability and effectiveness of liquid films for rapid heat removal are under study. Support through predoctoral fellowships was provided for research on advanced manufacturing serving as an investment in human resources.	In mechanical sciences, support is maintained for peer reviewed research on advanced manufacturing technologies, providing for the maintenance of predoctoral fellowships addressing basic energy-related problems in integrated manufacturing. The first group of 12 fellows will graduate from this program. Research on multiphase flows will continue, as will work on new concepts in radiative heat transfer. Further improvements in understanding causes and evolution of damage in and subsequent failure of structures are pursued. Special attention is paid to the effects of periodic and random thermomechanical loadings on the longevity of energy related structures. Researchers are strongly encouraged to extend their contacts with industry and thereby enhance technology transfer.	In mechanical sciences, effort on understanding the formation of foams and their motion will continue. Mixtures of oil and gas will form foams. The motion of such foams in a porous medium, a typical oil and gas well environment, differs from the transport of stratified oil and gas. Efficient exploitation of a well must take those differences into account. Thirty-six three-year advanced manufacturing predoctoral fellowships will be supported. Work on the behavior of suspensions and slurries important to industrial processes and fossil energy transport will be supported. Studies of the hydrodynamics of mixing in the boundary layer will proceed. This advanced experimental and theoretical study should eventually help with understanding the pollutant dispersion in the lower atmosphere. Studies will proceed on the flow of thin liquid films in heat transfer systems.
	In the area of control systems and instrumentation, under the Advanced Materials and Processing activities, there is an increasing research effort on appropriate instrumentation, diagnostics, and relevant process control methods. Studies of propagation of solitons in fiber optics, a means for enhancing information transfer rates, are proceeding as is research on high critical temperature superconducting devices. Forty industrial firms use chemical process control software	Studies in the area of control systems and instrumentation continue with the development of diagnostics and instrumentation for sustainable advanced materials processing, and for bioprocessing of fuels and energy related wastes. Further effort is exerted in the general field of intelligent machines, and in particular use of video signals will be explored for the control and precise positioning of end effectors on robotic arms. Research on novel approaches to measuring properties of fluid mixtures	The effort in the area of control systems will include further expansion of interactions with industry aiming at transferring the basic knowledge to practical applications. Of special interest are interacting autonomous systems, and reconfigurable systems which can adapt to changing tasks and environments. The interface between biology and chemical process control will continue to strengthen, aiming at improving the practicality and economic viability of biological processes in industrial and environmental

III. Engineering and Geosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Engineering Research (Cont'd)	developed under this program, saving individual companies millions of dollars per year. Chemical process engineering research is increasingly directed toward bioprocessing problems. Topics in autonomous intelligent machines included related issues in the fundamentals of advanced manufacturing and agile manufacturing such as research on heterogeneous distributed computing systems. A novel mobile platform which combines rotation with translatory motion aroused industrial interest and received the much sought after IR100 award.	such as environmentally sound refrigerants continues.	applications, e.g., contributing to SUSTAINABLE DEVELOPMENT by the production of amino acids by fermentation, coal and oil beneficiation, and reduction of environmental damage.
	No activity.	No activity.	A new ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS initiative in engineering research will stress development of basic information used in advanced manufacturing and processing. The objective is to insure that advanced waste minimization and control technologies rest on a sound foundation. The initiative will build on the strong existing programs in mechanical sciences, control systems, and engineering analysis.
	In engineering data and analysis, research continued on transport of energy through random media, contributing among other things to improved models of cloud cover in global climate studies. Concepts from the field of aerodynamics are applied to new ways of depositing hard coatings on soft substrates. Support continued for the University-National Laboratory collaborative research on plasma processing of materials. Possible direct communication paths among members of bacterial colonies are studied together with the effect such	Peer-reviewed research topics in engineering data and analysis include characterization of mixtures of fluids important to secondary and tertiary oil recovery, novel approaches to a better understanding of turbulent flows, and extension of methods for modeling hysteresis in a wide range of engineering systems. Theories of wave propagation in nonuniform media will be applied to improving the design methods for nonimaging optical systems, such as solar collectors, area illumination systems, and various related consumer products. Non-linear methods for	Research in engineering data and analysis will continue support for the thermochemical data needed for the separation of aqueous-hydrocarbon mixtures, information that is needed for industrial processes and for environmental cleanup. Advances in the theory of non-linear systems will be used to obtain simplified, but realistic representations of complex natural phenomena such as the seemingly chaotic changes in river flow rates and water levels in lakes. Studies of enzyme activity in organic solvents and at liquid-liquid interfaces will

III. Engineering and Geosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Engineering Research (Cont'd)	paths may have on adaptive control systems for bioprocessing. A joint University-National Laboratory project continued to characterize the rheological and transport properties of dense suspensions alongside related individual research projects. Utilization of DOE experimental and computational facilities by outside engineering researchers is strongly encouraged. Fundamental research on the response of bubbles in water to sound excitation has led to novel medical diagnostic techniques. A joint project with NASA is contributing to innovative engineering education in HBCUs.	control of chaos in manufacturing processes will be exploited.	provide basic information for the design of future bioreactors to be used in the conversion, e.g., liquefaction of coal in the Fossil Energy program.
	EPACT:	EPACT:	EPACT:
	EPACT Section 2202 "National Advanced Manufacturing Technologies Initiative":	EPACT Section 2202 "National Advanced Manufacturing Technologies Initiative:"	EPACT Section 2202 "National Advanced Manufacturing Technologies Initiative:"
	The Basic Energy Sciences program conducted research related to the goals of EPACT in the area of advanced manufacturing technologies.	The Basic Energy Sciences program conducts research related to the goals of EPACT in the area of advanced manufacturing technologies.	The Basic Energy Sciences program conducts research related to the goals of EPACT in the area of advanced manufacturing technologies.
	INVESTMENT:	INVESTMENT:	INVESTMENT:
	Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.
	Funding in the amount of $241,000 and $8,000 has been transferred to the SBIR program and the STTR program, respectively.	Funding in the amount of $322,000 and $16,000 has been budgeted for the SBIR program and the STTR program, respectively.	Funding in the amount of $368,000 and $27,600 has been budgeted for the SBIR program and the STTR program, respectively.
	$ 16,214	$ 16,422	$ 18,402

III. Engineering and Geosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Geosciences Research	Mineral-Fluid Interactions - Available funds provided for a strong continuing research program on mineral-fluid interactions. Research emphasizes the use of advanced instrumentation and capabilities for time-and space-resolved studies of mineral reactions in the presence of geologic fluids. Use of synchrotron radiation facilities at Stanford and Brookhaven are providing a base for future use of new capabilities at the 6-7 GeV Synchrotron Radiation Source. Instrumentation of a beam-line at the Advanced Photon Source is being provided via a research consortium in partnership with the National Science Foundation.	Mineral-Fluid Interactions - The appropriation provides for maintenance of an effective research program on basic rock, mineral and fluid properties. Program support of beam-line instrumentation at the 6-7 GeV Synchrotron Radiation Source will continue, as will use of synchrotron radiation facilities at Stanford and Brookhaven to study mineral-fluid reactions at the at the atomic and molecular scale. The level of effort in studies related to solar physics, solar-terrestrial interactions, and research directed toward developing and understanding of high-pressure-high temperature geologic processes will be reduced.	Mineral-Fluid Interactions - The request provides for a continued, strong research program in mineral-fluid interactions at the atomic and molecular scale. The research will emphasize integration of numerical and computational modeling of reactions with data derived from advanced chemical characterization of reacting mineral surfaces. Research effort will expand to use the 6-7 GeV Synchrotron Radiation Source in addition to synchrotron facilities at Stanford, Brookhaven, and Berkeley. Expanded effort is expected in developing ways and means to use information obtained at the atomistic scale in larger scale problems.
	Scientific Drilling - The Interagency Continental Scientific Drilling Program continued to evolve to a broader research program involving the dynamics of continental systems. The theme of the cooperative, interagency (NSF, USGS, DOE) effort is to develop approaches which better integrate geologic and geophysical studies to treat dynamics aspects of continental evolution as a whole, rather than as a collection of disparate disciplinary efforts. Research themes included effects of catastrophic events, such as meteorite impacts, on the face of the earth, potential volcanic events, and earthquakes in addition to ongoing studies bearing on energy resources.	Scientific Drilling - Drilling activities under the Continental Scientific Drilling Program will be reduced to provide support for site-characterization studies needed for future interagency scientific drilling projects. Current interagency projects which involve proposed scientific drilling at the Great Bahamas Banks, along the San Andreas Fault zone, and the Chixchulub Impact crater in Mexico, and in southern California are being studied in the pre-drilling mode. The U.S. Continental Scientific Drilling Program is becoming a part of an international scientific drilling program reflecting interest and commitment expressed in international scientific conferences during 1993 and 1994.	Scientific Drilling - The request will provide for continued participation in the interagency continental scientific drilling program including a new international component led by NSF. New efforts in the U.S. program will take full advantage of core and samples obtained in previous scientific drilling efforts to garner further geophysical and geochemical information. There will be continued emphasis on broad-based studies which use scientific drilling as an essential, but not sole, tool in obtaining basic information regarding the dynamic response of the earth's continental crust anthropogenic and natural processes.

III. Engineering and Geosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Geosciences Research (Cont'd)	Geophysical Imaging - Special emphasis was given to cross-cutting basic research which provided new knowledge on the origin, migration, and entrapment of hydrocarbons in the context of exploration and production for natural gas resources. Much of this research was carried out at universities and laboratories involving direct collaboration with industry via industry-funded consortia. Research focus was on fundamental aspects of subsurface fluid flow, including detection and characterization, and it involves modeling supported by direct field observations. Though focused on oil and gas issues, common aspects of the in situ processes can also shed light on issues related to migration of contaminated ground water.	Geophysical Imaging - The program continues to maintain a vigorous effort in geophysical imaging and analysis of fluid transport in geologic media. Seismic and electromagnetic methods or approaches form the core of the geophysical imaging program. Research which involves research support of university and DOE laboratory programs which involve participation of industry in research consortia continues as a significant part of the program. Industry participation in research will be increased under the Advanced Computational Technology Initiative of the Domestic Gas and Oil Initiative through joint DOE Laboratory-Industry research projects on geophysical identification and characterization of gas and oil reservoirs.	Geophysical Imaging - The request provides for a strong research program in using geophysical imaging techniques to determine the scale and nature of spatial heterogeneities in porous and fractured rocks of the earth's crust. The methods and techniques will stem from collaborative research in universities, DOE laboratories, and industry. They represent a core capability necessary to characterize the depths of the earth to deal with issues related to more efficient and effective use of the Nation's energy resources. An improved level of understanding of spatial heterogeneity is important in development and use of modeling of subsurface fluid transport in energy resource reservoirs.
	Environmental Geophysics - Available funds provided for a continued strong program directed toward providing basic scientific data needed for prediction of the interaction of rocks, minerals and fluids with contaminants under conditions found in the earth's shallow crust. Characterization of potential disposal sites for radioactive and chemical wastes rests heavily on non-penetrative geophysical interrogation, a theme in the research program dealing with geophysical imaging. Basic research in mineralogy and geochemistry provides knowledge on the geologic stability of engineered hosts for long-term isolation of toxic and hazardous constituents from mankind.	Environmental Geophysics - The appropriation provides for a continuing research program in geophysics which bears on non-penetrative characterization of current and potential sites for disposal of hazardous and radioactive wastes. This effort is complemented by a strong research program in geochemistry and mineralogy which provides information needed in predicting the consequences and effects of radioactive and hazardous waste disposal in the geologic environment. It is expected that some of the geophysical research will shift to improved definition of basic research needs associated with monitoring active and closed waste disposal sites.	Environmental Geophysics - The request strengthens a program emphasizing high-resolution geophysical imaging techniques for characterizing contaminated sites. The combination of electromagnetic and seismic methods in new approaches provides a foundation for simultaneous analysis of the data, with a resultant improved reliability of the interpretation. This integration will form the basis for definition of an effective monitoring technique for waste sites. Although developed with an emphasis on near-surface geologic media, it is expected that the basic approach will be readily adaptable to deep-seated problems and issues of importantance in finding hidden energy resources.

III. Engineering and Geosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Geosciences Research (Cont'd)	Fundamental Properties - Acquisition of fundamental data on transport processes in the geologic milieu continued to be a core program component. Kinetic, thermodynamic, and transport data on reactions of minerals with natural or contaminated fluids is the base in assessing potential for release, or capture, of hazardous and toxic constituents which are presently in the geologic environment.	Fundamental Properties - Research supports acquiring fundamental data relevant to reactions in porous and fractured rocks of the earth's upper crust. Program emphasis is on low-temperature reaction of rocks and minerals with ground water, hydrocarbons, geothermal fluids, and contaminated ground water.	Fundamental Properties - The research effort emphasizes fundamental thermodynamic, kinetic, and transport data on rocks, minerals and geologic fluids which are essential in predicting behavior of natural and perturbed systems. It is expected that the program element concerned with isotope geochemistry will emphasize isotopic tracers of geochemical processes.
	SUSTAINABLE DEVELOPMENT - DOE laboratory researchers continued to take advantage of opportunities for close coupling of basic/applied research at the operating level. Interaction of university, DOE laboratory, and industry researchers is increasing and is reflected in multi-institutional research projects. Both of these themes are leading to improved transfer of ideas, data, and concepts to those involved with applied research and development.	SUSTAINABLE DEVELOPMENT - Use of basic knowledge from the research program to strengthen the Nation's economic position through rapid dissemination of knowledge is an underlying theme of the program. We continue to explore alternative methods to foster greater interaction with industry researchers and continue support of university, DOE laboratory, and Industry consortia through competitive research proposals.	SUSTAINABLE DEVELOPMENT - The research program deals with both the origin and distribution of energy resources, and the disposal of associated wastes in geologic media. Thus, the research program provides information needed by policy makers in devising ways and means to satisfy current energy, economic, and environmental needs while insuring the means to provide for future needs in these areas.
	No activity.	No activity.	ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS - Geosciences research will support a new initiative in ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS emphasizing fundamental knowledge requirements needed to develop new and innovative geophysical and geochemical techniques for in situ measurement and monitoring of flow and interaction of fluids, rocks and soils. The goal is to insure that the new techniques are soundly based and provide information which can be used to predict overall system behavior. Research participants will be from industry, academia, and federal laboratories.

III. Engineering and Geosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Geosciences Research (Cont'd)	INVESTMENT: Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package. Funding in the amount of $287,000 and $10,000 has been transferred to the SBIR program and the STTR program, respectively.	INVESTMENT: Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package. Funding in the amount of $381,000 and $19,000 has been budgeted for the SBIR program and the STTR program, respectively.	INVESTMENT: Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package. Funding in the amount of $434,000 and $33,000 has been budgeted for the SBIR program and the STTR program, respectively.
	$ 19,323	$ 19,423	$ 21,551
Engineering and Geosciences	$ 35,537	$ 35,845	$ 39,953

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Advanced Energy Projects

The Advanced Energy Projects (AEP) subprogram provides support to establish the feasibility of novel, energy related ideas. The ideas can be stimulated in many ways, but usually arise from advances in basic research or from novel exploratory energy concepts that do not readily fit into an existing program area. The AEP subprogram spans the Department's energy mission. The high risk associated with an AEP project is properly balanced by a high payoff for the Nation's energy posture if the project is successful. The payoff will include concepts that advance Departmental research and development initiatives. Projects are typically supported at a level of $300,000 per year for a period of three years. Although funding profiles can vary among projects in the AEP subprogram, the three year budget period is considered the maximum. Following AEP support, it is expected that each concept will be sufficiently established and, if promising, will attract further funding from other sources to realize its full potential. The AEP subprogram does not support either ongoing, evolutionary research or large scale demonstration projects. Projects are selected on the basis of proposals submitted by universities, industrial organizations, non-profit research institutions or private individuals. The AEP subprogram also considers ideas or concepts submitted by researchers at national laboratories. Equal consideration is given to all submissions. The AEP subprogram will have a role in the new initiative for ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS.

II. A. Summary Table: Advanced Energy Projects

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Advanced Energy Projects	$ 10,697	$ 10,811	$ 12,026	$ 1,215
Total, Advanced Energy Projects	$ 10,697	$ 10,811	$ 12,026	$ 1,215

II. B. Laboratory and Facility Funding Table: Advanced Energy Projects

Argonne National Lab (East)	$ 1,358	$ 282	$ 300	$ 18
Lawrence Berkeley Lab	528	750	630	-120
Los Alamos National Laboratory	735	380	380	0
Oak Ridge National Lab	771	0	0	0
Lawrence Livermore National Lab	1,345	1,331	1,024	-307
National Renewable Energy Lab	725	1,362	1,150	-212
All Other	5,235	6,706	8,542	1,836
Total, Advanced Energy Projects	$ 10,697	$ 10,811	$ 12,026	$ 1,215

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

Program Activity	FY 1994	FY 1995	FY 1996
Advanced Energy Projects			
Advanced Energy Projects	Provided funds to explore the feasibility of a sufficient number of new concepts that could contribute to the Nation's energy economy. Funds were also available to continue and complete existing projects as planned. These projects included the exploration of renewable polymers from plant sources of monomers, solar detoxification of aquatic systems with porous photocatalysts and ultrafast molecular electronic devices. Subprogram activities were coordinated with DOE technology development programs to identify emerging areas of mutual interest. Research was emphasized in high-leverage areas within the Department's energy mission such as new approaches for producing alternate feedstocks and fuel and novel processing techniques of advanced materials for energy conversion, energy generation, or transportation.	Provides funds to initiate seven to ten new projects. It is expected that these projects would emphasize new areas of opportunity for the Department. Areas viewed as promising include smart materials, catalytic antibodies, self-reinforcing materials, thermoelectric materials for heating and refrigeration, "clean" alternatives for cars, and alternate methods for removal of metals from coal. Existing projects in the portfolio will be continued toward completion, provided they remain promising. Subprogram activities will continue to be coordinated with the Department's technology development programs to identify areas of mutual benefit.	Provides funds to initiate about ten projects. Emphasis will be placed on concepts in new areas of opportunity for the Department, such as SUSTAINABLE ENERGY DEVELOPMENT. Candidate topical areas for support include clean energy production through unusual or untried methods, such as a heat-to-electricity conversion process, called thermophotovoltaics; energy efficient methods for refrigeration that do not use harmful chemical compounds; and methods which could lead to the development of new materials for energy use. Funds are also available to continue existing projects toward completion, provided they remain promising. Those projects include two unusual methods for cooling, magnetic and thermoelectric processes; unique energy conservation techniques; and innovative processes for energy applications.
	No activity.	No activity.	Several ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS with industry will be initiated to explore new methods that are energy-efficient and environmentally benign.
	INVESTMENT:	INVESTMENT:	INVESTMENT:
	Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.
	Funding in the amount of $159,000 and $5,000 has been transferred to the SBIR program and the STTR program, respectively.	Funding in the amount of $212,000 and $10,600 has been budgeted for the SBIR program and the STTR program, respectively.	Funding in the amount of $240,500 and $18,000 has been budgeted for the SBIR program and the STTR program, respectively.

III. Advanced Energy Projects (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Advanced Energy Projects (Cont'd)	$ 10,697	$ 10,811	$ 12,026
Advanced Energy Projects	$ 10,697	$ 10,811	$ 12,026

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Energy Biosciences

The mission of the Energy Biosciences subprogram is to provide the scientific foundation for the use of biological systems to address the Nation's energy-related goals. The biological systems studied are primarily plants and microorganisms that are intimately associated with solar energy capture and the conversion of atmospheric carbon into bulk chemicals and potential fuels. Plants and microbes also offer enormous metabolic capabilities that are potentially useful for such energy related activities as the recovery and benefaction of fossil fuels, the adaptation to dramatically affect efficient industrial processes and products, and the prevention and remediation of contaminated environments.

The programmatic mission of Energy Biosciences has three main components. One of the major objectives is to provide the fundamental research base essential to the Department's technology programs. This effort is coordinated through numerous joint planning activities and the BioEnergy Coordinating Committee. As an example of interaction in 1994, a jointly sponsored workshop was organized by Energy Biosciences and an Environmental Restoration program unit on determining the basic and applied research needs relating to the use of plants in bioremediation. Another component includes research activities that while not directly supporting current specific technology programs, offer much promise to develop radically new technologies and strategies to aid the Department in fulfilling it's mission. An example of this relates to the enhancement of carbohydrate structural research where many new insights are being gained about polysaccharides which are abundant and valuable resources. The last component is to support the infrastructure needed to carry out biological research. These activities include the development and maintenance of databases and new technologies and various essential training efforts. These activities are frequently multiagency supported. The formal and informal coordination between agencies allows each agency to support those components that are unique to each agency's mission while efficiently using resources common to all biological science research.

The program, due in large part to the nature of the scientific disciplines involved, primarily invests in individual investigators who are able to generate new and innovative scientific concepts. An annual solicitation for research applications is open to all components of the Nation's research complex. Projects are selected for support based on the scientific merit as determined by extensive peer review and the potential to positively impact energy matters. This strategy has been successful in providing a large return as many of the discoveries are readily and quickly adopted by the commercial sector.

This subprogram will have a major role in the new initiative on ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS.

II. A. Summary Table: Energy Biosciences

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Energy Biosciences	$ 25,464	$ 27,936	$ 29,534	$ 1,598
Total, Energy Biosciences	$ 25,464	$ 27,936	$ 29,534	$ 1,598

II. B. Laboratory and Facility Funding Table: Energy Biosciences

	FY 1994 Adjusted	FY 1995 Estimate	FY 1996 Request	$ Change
Brookhaven National Lab	$ 1,047	$ 1,045	$ 1,050	$ 5
Lawrence Berkeley Lab	1,122	1,005	1,050	45
Los Alamos National Laboratory	131	131	131	0
National Renewable Energy Lab	135	135	135	0
All Other	23,029	25,620	27,168	1,548
Total, Energy Biosciences	$ 25,464	$ 27,936	$ 29,534	$ 1,598

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

Program Activity	FY 1994	FY 1995	FY 1996
Energy Biosciences			
Energy Biosciences	The research and training activities have been maintained with few changes. A number of new research projects were initiated principally utilizing the resources obtained from terminations of prior projects. Two notable additions were the initiation of new multidisciplinary research training units in plant biochemistry and the merging of biophysical and traditional biological approaches. Preparations were also made for research in phytoremediation by holding a research needs workshop.	The current program will maintain current activities. A few new projects are to start in various topic areas including the support of projects that relate to generating essential information about how plants absorb ions and the subsequent manner in which such absorbed items are handled internally. Other basic science projects in the numerous topic areas of the Energy Biosciences program scope will be initiated that will have a bearing on technology development of energy relationship.	This period will include maintenance of activities related to energy topics. The overall objective is to further technology development in providing new means of bioproduction of fuels and chemical feedstocks, new techniques for using plants and microbes for restoring polluted sites, and building the basis for new biological systems essential for tomorrow's sustainable technologies.
	Primary Biological Production - The important efforts within the area of primary biological production consisting of photosynthesis and other research related to plant productivity were maintained. Some examples of specific topic areas included pursuing the formation of lignin and its role in plant rigidity.	Primary Biological Production - The important efforts within the area of primary biological production consisting of studying regulation of plant growth and development and other key topics will be continued. Included in this year's effort is the initiation of basic studies that relate to phytoremediation.	Primary Biological Production - The area of primary biological production consists of solar energy conversion, plant growth, and development research on how plant growth is controlled. Mutants and other technologies will be used to discern the mechanisms of growth regulation. This ultimately includes gaining knowledge about how cell wall formation is controlled, and bears on not only the structure of cell walls but also on the ultimate

III. Energy Biosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Energy Biosciences (Cont'd)			structure and productivity of plants as a renewable resource.
	Primary Product Conversion - The program's activities in the metabolic diversity of microorganisms were emphasized as well as studies on the structure of plant cell walls and the synthesis of other biopolymers.	Primary Product Conversion - The program's activities will continue at approximately the FY 1994 level. A few new projects relating to plant and microbial biochemistry pathways including plant cell wall structure and biosynthesis will be initiated. Included in this year's effort is the initiation of basic studies that relate to phytoremediation.	Primary Product Conversion - The program focus will be supplemented by additional projects dealing with the biochemistry of plants, including basic information that will be of interest to and use by industry, especially those with the objective of SUSTAINABLE DEVELOPMENT.
	Biotechnology Foundation - The investigations falling within this category, such as studies on the regulation of genetic expression in plants and microbes as well as other types of investigations that help to provide the basis for new biotechnologies, were sustained.	Biotechnology Foundation - Research will continue at the FY 1994 level of effort. In addition, new projects dealing with genetic mechanisms of plant and unusual microorganisms will replace some current projects. That is, some turnovers will occur.	Biotechnology Foundation - The program focus will be supplemented by projects designed to support research in plant and microbial sciences that affects techniques and also the training of scientists for inclusion in future biotechnology development. The areas to be focused on include microbial physiology.
	Coordination - The program was able to continue to be an active participant in the activities associated with the DOE/NSF/USDA Plant Science program providing opportunities in research training and research networking. Efforts to formulate a joint activity with NSF regarding microbiological research were initiated. Joint technical workshop with another DOE office on phytoremediation was convened.	Coordination - The program plans to continue its participation in the DOE/NSF/USDA Plant Science program. Further interactions with NSF on microbial physiology are planned. The program also plans to help initiate and participate in the Interagency Plant Science Research Group to provide a broader participation in plant science research coordination.	Coordination - The program will continue to be an active participant in the DOE/NSF/USDA Plant Science program, as it will likely hold an open competition to provide opportunities in research training and related activities. The program intends to develop new activities with the NSF related to training the future generation of microbial physiologists.

III. Energy Biosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Energy Biosciences (Cont'd)	Infrastructure/Training - The program was able to continue to support ongoing activities associated with the DOE/NSF/USDA Plant Science program providing opportunities in research training and research networking. Two new activities in research training were added. The program also initiated a very small activity in conjunction with NSF to foster graduate training in microbial physiology. A small post doctoral fellowship program was also continued as was support for CarbBank, a database of complex carbohydrate structures.	Infrastructure/Training - The program plans to continue the commitments presently in place relating to research training, research networking, and database maintenance. The program will also explore the possibility of establishing activities that will lead to training research professionals with the necessary interdisciplinary breadth to address such problems as phytoremediation.	Infrastructure/Training - The program plans to continue the commitments presently in place relating to research training, research networking, and database maintenance. The program will continue to be an active participant in the DOE/NSF/USDA Plant Science program, as it will likely hold an open competition to provide opportunities in research training and related activities. The program intends to develop new activities related to training the future generation of microbial physiologists (currently in great demand in all research sectors). Similarly, activities related to broadening the range of training available to young researchers interested in the plant/soil/microbe interface will likely be pursued by the program.
	No activity.	No activity.	The mission of the Energy Biosciences program is central to the objectives of the ENVIRONMENTAL TECHNOLOGY PARTNERSHIP program. Specifically, there are a number of topic areas that have not received sufficient support to generate the basic understanding requisite for the rapid and effective development of environmentally rational technologies. Among the most critical topic areas are: Broader and deeper understanding of biochemistry of plant and microbial systems that can be used to generate new environment preserving products and processes. Attainment of detailed knowledge on plant absorption and translocation of particular ions and related chemicals critical for the development of "phytoremediation" technologies. Research on plant-microbe-soil interactions likewise offers great potential in developing effective and economic

III. Energy Biosciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Energy Biosciences (Cont'd)			clean-up and waste control technologies. Ascertaining the way in which plant cell walls (a major renewable resource derived from atmospheric CO2) are synthesized and degraded along with their function.
	INVESTMENT:	INVESTMENT:	INVESTMENT:
	Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	Provides funding for continuation of advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.
	Funding in the amount of $378,000 and $13,000 has been transferred to the SBIR program and the STTR program, respectively.	Funding in the amount of $545,000 and $27,300 has been budgeted for the SBIR program and the STTR program respectively.	Funding in the amount of $591,000 and $44,300 has been budgeted for the SBIR program and the STTR program, respectively.
	$ 25,464	$ 27,936	$ 29,534
Energy Biosciences	$ 25,464	$ 27,936	$ 29,534

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Applied Mathematical Sciences

The Applied Mathematical Sciences (AMS) subprogram mission is to improve the ability of the Department to solve scientific and engineering problems which are critical to its mission, through research and development in and applications of advanced mathematical, computational, computer, and communications sciences and information technologies and, as authorized, to meet the requirements of the High Performance Computing Act of 1991. The Office of Scientific Computing, Office of Energy Research, manages this diverse and forefront AMS subprogram which spans the spectrum of activities from fundamental research to technology development. The AMS subprogram, through the Mathematical, Computational, and Computer Sciences Research (MCCSR) Activity, supports fundamental research, computational and computer science, and educational programs in critical areas needed by all DOE program components. The AMS subprogram, through the Advanced Computation, Communications Research, and Associated Activities (ACCRA) Activity provides leading edge information technology infrastructure to support researchers funded by the Office of Energy Research, including implementation of large scale high performance computing system prototypes for computational research, supercomputer access for over 4,000 researchers nationwide, the Energy Sciences Network (ESNet), National Information Infrastructure, and industrial technology activities.

To fulfill this mission, the AMS subprogram seeks to:

o Ensure access by energy researchers to continually improve mathematical, computational, and computer science techniques and methods through appropriate investments in basic long range applied mathematics, computational, and computer science research;

o Ensure an adequate supply of appropriately trained computational scientists and engineers to support the scientific research and Energy Policy Act requirements of the Department, and the national security, and economic competitiveness needs of the United States;

o Ensure the availability of and continuing improvements to a nationwide high performance computing, communications and information technology infrastructure which supports the requirements of energy researchers for collaboration and advanced resources;

o Ensure the availability from United States sources of high performance computing hardware and software resources and technology advances which enable the solution of critical scientific and engineering problems for the Office of Energy Research, the Department of Energy, and the Nation;

o Ensure effective industrial involvement in the Office of Energy Research, the effective transfer of knowledge and technology in high performance computing, communications, and information technologies from government-sponsored research to United States industry, and the effective diffusion of these technologies into energy related applications.

Because of this mission and the computationally intensive nature of energy related applications and problems, the Department of Energy, perhaps more than any other agency, depends for its mission accomplishment on advancements in computational techniques and computer and networking technologies. As a result, DOE has a long history of computational research and development, with strong industrial and university cooperation. The Department's Applied Mathematical Sciences subprogram was initiated in the early nineteen fifties at the suggestion of John von Neumann to enhance understanding of the use of digital computers in nuclear applications. Consequently, the Department has been prominent in maintaining the United States leadership in high performance computing and communications, in encouraging, and even providing, innovation in HPCC and other information technologies, and in supporting United States economic, scientific, and technological competitiveness and productivity through its extensive use of these technologies and their application in a national information infrastructure.

I. Applied Mathematical Sciences (Cont'd)

The unique contribution and value of the Department's AMS subprogram results from the Department's role as a pioneer in the use of supercomputers for numerical simulation of complex systems that reduce substantially the cost of experimentation and testing and that also reduce the adverse effects on the environment. Because of this experience, the Department of Energy is playing a major role in the multiagency High Performance Computing and Communications and the National Information Infrastructure Programs, both in its program initiatives and in program management. The High Performance Computing Research Centers, at Oak Ridge National Laboratory and Los Alamos National Laboratory, both operate prototype computational systems providing support to approximately eight grand challenge class computational energy projects. The National Energy Research Supercomputer Center at Lawrence Livermore National Laboratory will begin work to transition a prototype massively parallel computing system into a production environment.

Applied Mathematical Sciences will participate in the Domestic Natural Gas and Oil Initiative through the Advanced Computational Initiative. The work will be focused on fundamental research on applied mathematics of seismic phenomena, modeling of reservoir dynamics, flow of gases and liquids in heterogeneous media, and transport of contaminants.

Equally important, as noted above, this program includes research and development in advanced communications which offers to radically transform the way in which all Americans work. Accordingly, the National Research and Education Network component of the High Performance Computing and Communications Program is considered to be the prototype for a national information infrastructure which will improve our abilities to manage energy demand and will greatly assist in our efforts to reduce our dependence on energy imports through telecommuting and other means that substitute electronic communications for physical transport of people and goods.

This subprogram will have a major role in the new initiative on ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS.

II. A. Summary Table: Applied Mathematical Sciences

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Mathematical, Computational, and Computer Sciences Research	$ 49,309	$ 52,105	$ 52,114	$ 9
Advanced Computation, Communications, and Associated Activities	49,742	56,011	56,574	563
Total, Applied Mathematical Sciences	$ 99,051	$ 108,116	$ 108,688	$ 572

II. B. Laboratory and Facility Funding Table: Applied Mathematical Sciences

Ames Lab	$ 5,707	$ 4,941	$ 4,710	$ -231
Argonne National Lab (East)	7,969	7,730	7,432	-298
Lawrence Berkeley Lab	7,790	3,370	3,400	30
Lawrence Livermore National Lab	32,440	35,700	33,572	-2,128
Los Alamos National Laboratory	11,524	11,113	10,849	-264
Oak Ridge National Lab	11,460	10,443	9,630	-813
Sandia National Laboratories	4,060	3,588	3,399	-189
All Other	18,101	31,231	35,696	4,465
Total, Applied Mathematical Sciences	$ 99,051	$ 108,116	$ 108,688	$ 572

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

Program Activity	FY 1994	FY 1995	FY 1996
Applied Mathematical Sciences			
Mathematical, Computational, and Computer Sciences Research	Basic Research and Human Resources (BRHR) research in analytical and numerical methods continued to pursue fundamental research in areas important for understanding the physical, chemical, and biological processes related to energy production, use, and conservation. Basic research in this area also investigated parallel numerical algorithms, geometry, and adaptive mesh techniques as part of the HPCC program. HPCC educational programs continued at current levels of effort.	Basic Research and Human Resources (BRHR) research in analytical and numerical methods will continue to pursue fundamental research in areas important for understanding the physical, chemical, and biological processes related to energy production, use, and conservation. Basic research in this area will also investigate parallel numerical algorithms, geometry, and adaptive mesh techniques as part of the HPCC program. HPCC educational programs will continue with increased emphasis on programs for women and minorities.	Basic Research and Human Resources (BRHR) research in analytical and numerical methods will continue to pursue fundamental research in areas important for understanding the physical, chemical, and biological processes related to energy production, use, and conservation. Basic research in this area will continue investigating parallel numerical algorithms, geometry, and adaptive mesh techniques as part of the HPCC program. HPCC educational programs will continue increased emphasis on programs for women and minorities and also refocus toward improving educational technologies.
	High Performance Computing Systems (HPCS) research continued at a reduced level in performance measurements of parallel architectures, parallel systems technology development, and prototype hardware evaluation of high performance computing systems, including an IBM SP2 system at Argonne National Laboratory. HPCS continued support at HPCRCs.	High Performance Computing Systems (HPCS) research will continue at a reduced level in performance measurements of parallel architectures, parallel systems technology development, and prototype hardware evaluation of high performance computing systems. HPCS will continue support for small and full scale prototype systems at HPCRCs.	High Performance Computing Systems (HPCS) research will continue at a reduced level in performance measurements of parallel architectures, parallel systems technology development, and prototype hardware evaluation of high performance computing systems. HPCS will continue support for small and full scale prototype systems at HPCRCs, and for upgrades at the HPCRCs begun in FY 1995.

III. Applied Mathematical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Mathematical, Computational, and Computer Sciences Research (Cont'd)	Advanced Software Technology and Algorithms (ASTA) research continued in computational "grand challenges," computational techniques, and software tools and components research areas. The scope of applications research support and software components research focused on high leverage areas such as distributed environments and software tools for parallel systems. In addition, the "grand challenges" projects were reviewed and evaluated for scientific progress to focus on priority energy applications to accommodate planned growth in the other collaborations.	Advanced Software Technology and Algorithms (ASTA) research will continue in computational "grand challenges," computational techniques, and software tools and components research areas. The scope of applications research support and software components research will be focused on high leverage areas such as distributed environments and software tools for parallel systems. In addition, the "grand challenges" projects will be reviewed and evaluated for scientific progress to focus on priority energy applications to prioritize funding for these collaborations. Participation in the Domestic Natural Gas and Oil Initiative.	Advanced Software Technology and Algorithms (ASTA) research will continue in computational "grand challenges," computational techniques, and software tools and components research areas. Support for grand challenges projects will continue per the results of reviews completed in FY 1995. Support will be initiated for an interagency HPCC project to improve Input/Output/ Archival Storage for scalable distributed systems. Participation in the Domestic Natural Gas and Oil Initiative.
	EPACT:	EPACT:	EPACT:
	EPACT Section 2028 "Telecommuting Study":	EPACT Section 2028 "Telecommuting Study":	EPACT Section 2028 "Telecommuting Study":
	The two telecommuting studies initiated in FY 1993 were completed and their results published. The results will be used by DOE, and we expect other agencies, in determining future activities and research that can be undertaken in this area. ($100)	Since the two studies initiated in FY 1993 were completed in FY 1994 the studies did not require any additional funding.	Since the two studies initiated in FY 1993 were completed in FY 1994 the studies will not require any additional funding.
	INVESTMENT:	INVESTMENT:	INVESTMENT:
	Funds were provided for the HPCC activities included in the President's FY 1994 Economic Investment Package.	Funds are provided for continuation of the HPCC activities included in the President's FY 1994 Economic Investment Package.	Funds are provided for continuation of the HPCC activities included in the President's FY 1994 Economic Investment Package.
	Funding in the amount of $736,000 and $24,000 has been transferred to the SBIR program and the STTR program, respectively.	Funding in the amount of $1,035,000 and $51,750 has been budgeted for the SBIR program and the STTR program, respectively.	Funding in the amount of $1,042,000 and $78,000 has been budgeted for the SBIR program and the STTR program, respectively.

III. Applied Mathematical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Mathematical, Computational, and Computer Sciences Research (Cont'd)	$ 49,309	$ 52,105	$ 52,114
Advanced Computation, Communications, and Associated Activities	Continued funding for Cray Research, Inc., C-90 supercomputer installed in FY 1992 at the National Energy Research Supercomputer Center (NERSC). Continued support for installed, full scale prototype HPCS at the HPCRCs. Continued funding for supercomputer software tools for improved access to HPCC and mass storage systems.	Continue funding for Cray Research, Inc., C-90 supercomputer installed in FY 1992 at the National Energy Research Supercomputer Center (NERSC). Continue operational support for installed, full scale prototype HPCS at the HPCRCs. Introduce massively parallel system into the Energy Research supercomputer access program. Continue funding for supercomputer software tools for improved access to HPCC and mass storage systems.	Conclude funding for Cray Research, Inc., C-90 system and ramp up project to migrate massively parallel systems into NERSC environment; i.e., the ER supercomputer access program. Continue operational support for installed, full scale prototype HPCS at the HPCRCs. Continue funding for supercomputer software tools for improved access to HPCC and mass storage systems. This budget reflects a one year shift of $2,000,000 from operating expenses to capital equipment to support the acquisition of a disk/archival mass storage system at NERSC.
	Continued T3 (45 megabit) capability upgrades for the ESNet sites. Continued gigabit network research concentrating on multi-protocol support, interprocess communications techniques, and distributed computing technologies, e.g., those which enable telecommuting. Continued funding for the FSU/SCRI cooperative agreement.	Complete T3 (45 megabit) capability upgrades for the ESNet sites. Continue gigabit network research concentrating on multi-protocol and multicast technologies, high speed interprocess communications techniques, and distributed computing technologies, e.g., those which enable information infrastructure applications. Participation in the Domestic Natural Gas and Oil Initiative. ($2,000)	Initiate data communications services within the ESNet at rates of 155 megabits per second for select requirements. Continue gigabit network research concentrating on multi-protocol and multicast technologies, high speed interprocess communications techniques, and distributed computing technologies, e.g., those which enable information infrastructure applications. Continue support for qualified, peer-reviewed projects at Florida State University Supercomputer Computations Research Institute. Initiate projects in support of the National Information Infrastructure (NII) program, especially in enabling technologies to realize NII applications in energy demand and supply management, environment or education.

III. Applied Mathematical Sciences (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Advanced Computation, Communications, and Associated Activities (Cont'd)	No activity.	No activity.	Initiate ENVIRONMENTAL TECHNOLOGY PARTNERSHIPS initiative to use DOE expertise in modeling, optimization, and information technologies to improve industrial processes and monitoring and to use distributed data technologies to support process monitoring, research and development, and communication of best practices.
	INVESTMENT:	INVESTMENT:	INVESTMENT:
	Funds were provided for the HPCC activities included in the President's FY 1994 Economic Investment Package.	Funds are provided for continuation of the HPCC activities included in the President's FY 1994 Economic Investment Package.	Funds are provided for continuation of the HPCC activities included in the President's FY 1994 Economic Investment Package.
	Funding in the amount of $739,000 and $25,000 has been transferred to the SBIR program and the STTR program, respectively.	Funding in the amount of $1,104,500 and $55,000 has been budgeted for the SBIR program and the STTR program, respectively.	Funding in the amount of $1,131,000 and $85,000 has been budgeted for the SBIR program and the STTR program, respectively.
	$ 49,742	$ 56,011	$ 56,574
Applied Mathematical Sciences	$ 99,051	$ 108,116	$ 108,688

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Program Direction

This subprogram provides the Federal staffing resources and associated funding required to develop, direct, and administer a complex and broadly diversified program for mission-oriented research and scientific user facilities for the scientific and engineering community. The Nation's future energy, defense, and technology options depend on long-range research supported by this program. This staff administers a basic research program which helps us attain our national goals, i.e., better health and quality of life, economic competitiveness, energy self-sufficiency, and national security. The staff annually monitors and evaluates approximately 1,400 individual research projects at over 200 separate institutions.

II. A. Summary Table: Program Direction

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Personnel Compensation	$ 5,821	$ 6,323	$ 6,566	$ 243
Personnel Benefits	1,144	1,407	1,440	33
Travel	640	655	650	-5
Contractual Services	1,515	1,515	1,344	-171
Total, Program Direction	$ 9,120	$ 9,900	$ 10,000	$ 100

II. B. Laboratory and Facility Funding Table: Program Direction

All Other	$ 9,120	$ 9,900	$ 10,000	$ 100
Total, Program Direction	$ 9,120	$ 9,900	$ 10,000	$ 100

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

Program Activity	FY 1994	FY 1995	FY 1996
Program Direction			
Personnel Compensation	Provided funds for personnel compensation for 76 full-time equivalents (FTEs) in the Office of Basic Energy Sciences, the Office of Scientific Computing, and for related program and management support staff in the Headquarters and field. Included, for example, regular salaries, lump sum payments for unused annual leave, premium pay, and employee incentive awards.	Provide funds for personnel compensation for 84 FTEs. Includes, for example, regular salaries, lump sum payments for unused annual leave, premium pay, and employee incentive awards.	Provide funds for personnel compensation for 85 FTEs. Provides one FTE for the Technical Leadership Development Program and includes, for example, regular salaries, lump sum payments for unused annual leave, premium pay, and employee incentive awards. Provides for pay increases resulting, for example, from normal within-grade increases, locality and/or general pay raises.
	Funded staff for the Office of Basic Energy Sciences activities which included assessing the scientific needs and priorities of the program; planning to meet those needs; technical review of proposals from laboratories and universities; and monitoring the progress of ongoing university contracts, laboratory programs, and construction projects. Provided program management to meet National research goals supporting the country's energy-related technology foundation. Supported labor-intensive awards of university grants, monitored contractor management and accountability, and provided project management oversight, especially for the 6-7 GeV Synchrotron Radiation Source. Continued interaction with other DOE organizations on the Advanced Neutron Source (ANS), supported numerous current user facilities, and ensured ES&H compliance at large research facilities and construction projects. Interacted with other agencies and helped maintain world leadership in science and technology. Supported the Basic Energy Sciences Advisory Committee and managed the DOE-wide Small Business Innovation Research and	Continue to provide program direction and oversight of efforts to meet National research goals supporting the country's energy-related technology foundation. Continue to monitor contractor oversight and accountability and project management. Continue interaction with other DOE organizations to oversee completion of certain research and development and engineering design activities related to the ANS, support current user facilities, and ensure ES&H compliance. Manage ongoing research program activities. Continue to interact with other agencies and help maintain world leadership in science and technology. Continue to support the Basic Energy Sciences Advisory Committee and manage the DOE-wide SBIR/STTR programs.	Continue to provide program direction and oversight of efforts to meet National research goals supporting the country's energy-related technology foundation. Continue to monitor contractor oversight and accountability and project management. Oversee activities leading to the conceptual design of a spallation neutron source in lieu of the ANS, support current user facilities, and ensure ES&H compliance. Manage ongoing research program activities with increased emphasis on science for sustainable development and support increased facility operations. Continue to interact with other agencies and help maintain world leadership in science and technology. Continue to support the Basic Energy Sciences Advisory Committee and manage the DOE-wide SBIR/STTR programs.

III. Program Direction (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Personnel Compensation (Cont'd)	Small Business Technology Transfer (SBIR/STTR) programs.		
	Funded staff for the Office of Scientific Computing. Activities included policy and program planning, representation on interagency coordinating councils, management of research and development projects in mathematical and computational sciences, management of ER supercomputer centers and management of Energy Sciences Network (ESNet) development and operations. Supported the National Science and Technology Council (NSTC) high performance computing and communications (HPCC) program, requiring increased interaction among five Federal agencies with a major goal of transfer of technology to U.S. industry. Managed and coordinated the National Research and Education Network (NREN). Enhanced contractor oversight and accountability, and supported Energy Policy Act of 1992 requirements in the area of telecommuting. Supported the Administration's new program in Information Infrastructure Technology and Applications (IITA).	Continue to support all FY 1994 program areas and the interagency NSTC HPCC program. Support continued interagency computer network research and infrastructure program management and coordination of NREN. Manage proposals and research projects, including oversight of a massively parallel computing system and development of a program in IITA. Continue contractor oversight and accountability, and support Energy Policy Act of FY 1992 requirements in the area of telecommuting.	Continue to support all program areas and the interagency NSTC HPCC program. Support continued interagency computer network research and infrastructure program management and coordination of NREN. Manage proposals and research projects, including oversight of a massively parallel computing system and continued support of a program in IITA. Continue contractor oversight and accountability, and support Energy Policy Act of FY 1992 requirements in the area of telecommuting.
	Provided program and management support in the areas of budget and finance, personnel administration, acquisition and assistance, policy coordination, information resources management, and construction management support.	Continue to provide program and management support as in FY 1994.	Continue to provide program and management support as in FY 1995.

III. Program Direction (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Personnel Compensation (Cont'd)	Provided contract management oversight at Chicago Operations Office for construction of the 6-7 GeV Synchrotron Radiation Source. Supported all procurements, safety and environmental oversight, and project management activities related to that project, with increased emphasis on preparation for commissioning.	Provide increased technical and clerical support to the 6-7 GeV Synchrotron Radiation Source.	Continue to support the 6-7 GeV Synchrotron Radiation Source.
	$ 5,821	$ 6,323	$ 6,566
Personnel Benefits	Funded civilian personnel benefits to cover the Civil Service Retirement and Disability Funds, Federal Employees Retirement System, health benefits and life insurance funds, permanent change of station expenses, and unemployment compensation.	Fund civilian personnel benefits to cover the Civil Service Retirement and Disability Funds, Federal Employees Retirement System, health benefits and life insurance funds, permanent change of station expenses, and unemployment compensation.	Fund civilian personnel benefits to cover the Civil Service Retirement and Disability Funds, Federal Employees Retirement System, health benefits and life insurance funds, permanent change of station expenses, and unemployment compensation.
	$ 1,144	$ 1,407	$ 1,440
Travel	Provided funds for official domestic, international, and local travel. Funds transferee/new hire personnel for permanent change of station transportation.	Provide funds for official domestic, international, and local travel. Funds transferee/new hire personnel for permanent change of station transportation.	Provide funds for official domestic, international, and local travel. Funds transferee/new hire personnel for permanent change of station transportation.
	$ 640	$ 655	$ 650
Contractual Services	Provided a variety of program support such as printing and editing and contractual services, including, for example, support for the SBIR/STTR programs, ES&H activities, and timesharing on various information systems and communication networks; and Automated Office Support Systems (AOSS) workstations.	Provide at a reduced level a variety of program support such as printing and editing and contractual services, including, for example, support for the SBIR/STTR programs, ES&H activities, and timesharing on various information systems and communication networks; and Automated Office Support Systems (AOSS) workstations.	Provide at a reduced level a variety of program support such as printing and editing and contractual services, including, for example, support for the SBIR/STTR programs, ES&H activities, and timesharing on various information systems and communication networks; and Automated Office Support Systems (AOSS) workstations.

III. Program Direction (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Contractual Services (Cont'd)	$ 1,515	$ 1,515	$ 1,344
Program Direction	$ 9,120	$ 9,900	$ 10,000

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Capital Equipment

Capital equipment is needed to support the research in each of the subprograms in the Basic Energy Sciences program. In addition, general purpose equipment at Argonne and Ames is funded through BES. Studies done both by the Department and by the laboratories continue to stress the importance of modernization in order to take advantage of more technologically advanced, efficient and safe instruments and equipment. Much of the research in the BES program involves experiments at extremes of temperatures and pressure and requires unprecedented levels of resolution. Reliable, precise measurements under such conditions challenge the current state-of-the-art, and as improvements are made in instruments and equipment, it is important to benefit from them in a timely fashion. The quality of individual research projects and effective experiments at the major facilities depends on the availability of new state-of-the-art equipment and instrumentation, and on replacement of older, obsolete equipment.

II. A. Summary Table: Capital Equipment

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Capital Equipment	$ 43,544	$ 39,056	$ 56,973	$ 17,917
Total, Capital Equipment	$ 43,544	$ 39,056	$ 56,973	$ 17,917

II. B. Laboratory and Facility Funding Table: Capital Equipment

Ames Lab	$ 1,539	$ 1,679	$ 2,408	$ 729
Argonne National Lab (East)	13,228	10,471	15,022	4,551
Brookhaven National Lab	4,126	4,030	5,580	1,550
Idaho National Engineering Lab	255	288	338	50
Lawrence Berkeley Lab	8,564	4,346	6,628	2,282
Lawrence Livermore National Lab	1,382	1,409	5,920	4,511
Los Alamos National Laboratory	1,550	1,569	2,576	1,007
Oak Ridge National Lab	5,681	5,279	5,612	333
Pacific Northwest Lab	1,054	1,037	1,066	29
Sandia National Laboratories	2,202	2,066	2,499	433
Stanford Linear Accelerator Center	1,435	1,571	2,571	1,000
All Other	2,528	5,311	6,753	1,442
Total, Capital Equipment	$ 43,544	$ 39,056	$ 56,973	$ 17,917

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

Program Activity	FY 1994	FY 1995	FY 1996
Capital Equipment			
Capital Equipment	Continued core equipment funding at the FY 1993 level. Emphasis continued in areas which require ES&H attention and in areas which had high priority in the research programs. Equipment requirements at the major user facilities continued to be met. General purpose equipment requirements for Ames and ANL continued to be funded at the FY 1993 level. Acquisition of a field emission gun electron microscope, located at Lawrence Berkeley Laboratory, with a point-to-point resolution limit of about one Angstrom (TEC - $1.5M). Continued support of the High Performance Computing and Communications activities.	Continues core equipment funding at slightly below the FY 1994 level. Emphasis will continue in areas which require ES&H attention and in areas which have high priority in the research programs. Basic equipment requirements at the major user facilities will continue to be met. General purpose equipment requirements for Ames and ANL will continue to be funded at the FY 1994 level. Supports research experiments, workstations, small networking equipment, supercomputer peripheral items and associated items in conjunction with the High Performance Computing and Communications activities.	Continues core equipment funding at the FY 1995 level. Emphasis will continue in areas which require ES&H attention and in areas which have high priority in the research programs. Basic equipment requirements at the major user facilities will be enhanced in order to exploit the extraordinary capabilities made possible by these photon and neutron sources. Additional beamlines will be provided at NSLS, SSRL, ALS, HFBR and HFIR to meet the growing demand for x-rays and neutrons. Capital equipment enhancements will be provided to the Ames Materials Preparation Center, the Illinois Center for Microanalysis of Materials, the ORNL shared instrumentation program, and electron microscopy centers at LBL and LLNL. This request also includes an increase of $3,358,000 for the 6-7 GeV Synchrotron Radiation Source. General purpose equipment requirements for Ames and ANL will continue to be funded at the FY 1995 level. Continues support of the High Performance Computing and Communications activities. Additional funds are also provided for peripheral and test equipment to support the operation of NERSC. This budget reflects a one year shift of $2,000,000 from operating expenses to capital equipment to support the acquisition of a disk/archival mass storage system at NERSC.

III. Capital Equipment (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Capital Equipment (Cont'd)	INVESTMENT: Funds were provided for the HPCC activities included in the President's FY 1994 Economic Investment Package.	INVESTMENT: Funds are provided for continuation of the HPCC activities included in the President's FY 1994 Economic Investment Package.	INVESTMENT: Funds are provided for continuation of the HPCC activities included in the President's FY 1994 Economic Investment Package.
	$ 43,544	$ 39,056	$ 56,973
Capital Equipment	$ 43,544	$ 39,056	$ 56,973

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

BASIC ENERGY SCIENCES

I. Preface: Construction

Construction is needed to support the research in each of the subprograms in the Basic Energy Sciences program. Experiments necessary in support of basic research require that state-of-the-art facilities be built or existing facilities modified to meet unique research requirements. Reactors, radiation sources, and neutron sources are among the expensive, but necessary, facilities required. The budget for the BES program includes funding for the construction and modification of these facilities.

II. A. Summary Table: Construction

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Construction	$ 115,942	$ 70,379	$ 24,383	$ -45,996
Total, Construction	$ 115,942	$ 70,379	$ 24,383	$ -45,996

II. B. Laboratory and Facility Funding Table: Construction

Ames Lab	$ 810	$ 450	$ 550	$ 100
Argonne National Lab (East)	107,306	60,579	8,905	-51,674
Brookhaven National Lab	3,880	2,400	6,700	4,300
Lawrence Berkeley Lab	1,806	1,800	3,675	1,875
Oak Ridge National Lab	582	0	1,200	1,200
Sandia National Laboratories	175	150	2,105	1,955
Stanford Linear Accelerator Center	737	900	730	-170
All Other	646	4,100	518	-3,582
Total, Construction	$ 115,942	$ 70,379	$ 24,383	$ -45,996

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

Program Activity	FY 1994	FY 1995	FY 1996
Construction			
Construction	Provided necessary funds to continue at the approved schedule all projects underway in FY 1993.	Provides necessary funds to continue at the approved schedule all projects underway in FY 1994.	Provides necessary funds to continue construction of the 6-7 GeV Synchrotron Radiation Source at the approved schedule. Also provides for General Plant Projects at an increased level. The GPP funding for ANL will also support high priority ES&H activities identified in the Department's Five Year Plan. The Accelerator and Reactor Improvements and Modifications project has been increased to include upgrades of beamline instrumentation at NSLS, HFBR, HFIR, and ALS, and to provide for a new spallation target for the IPNS at ANL. Provides for continued funding to complete (in 4 years) the Combustion Research Facility, Phase II.
	EPACT:	EPACT:	EPACT:
	EPACT Section 2203(a)(2)(c) "Supporting Research and Technical Analysis":	EPACT Section 2203(a)(2)(c) "Supporting Research and Technical Analysis":	EPACT Section 2203(a)(2)(c) "Supporting Research and Technical Analysis":
	Provided funds for the construction of the 6-7 GeV Synchrotron Radiation Source at the Argonne National Laboratory. ($103,814)	Provides funds for the construction of the 6-7 GeV Synchrotron Radiation Source at the Argonne National Laboratory. ($58,379)	Provides funds for the construction of the 6-7 GeV Synchrotron Radiation Source at the Argonne National Laboratory. ($3,186)
	INVESTMENT:	INVESTMENT:	INVESTMENT:
	Provided funding for advanced materials and processing activities included in the President's FY 1994 Economic Investment Package.	No activity.	No activity.
	$ 115,942	$ 70,379	$ 24,383
Construction	$ 115,942	$ 70,379	$ 24,383

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

MAJOR USER FACILITIES

1. Preface: Major User Facilities

The major facilities discussed below are used to conduct forefront research in materials, chemistry, biology, medicine, and in the applied sciences using high fluxes of neutrons or photons. These facilities are unique in their ability to probe the structure and properties of important energy related phenomena. In view of the unique character of these facilities, scientists from all parts of the Nation travel to these facilities to conduct their research, including researchers from government laboratories, industry, universities, and DOE contractors. National committees and DOE committees have identified needs for advanced user facilities in order to conduct leading edge research. Funds have been included for those facilities requiring Nuclear Regulatory Commission certificates of compliance as directed by 10 CFR 170 and 171. This budget request includes funds to enhance the operations and to upgrade the major scientific facilities so their unique capabilities can be more fully exploited so that more user scientists are served and more experiments are carried out. This budget request includes construction funding in FY 1996 to complete the construction of the 6-7 GeV Synchrotron Radiation Source and operating funds to finish the testing and commissioning leading up to initial operation in FY 1997. This budget also includes construction funding in FY 1996, with project completion scheduled for FY 1999, for the Combustion Research Facility, Phase II. Summarized below is a list of each of these facilities, as well as a description of the activities underway in FY 1994 and FY 1995 to provide for their operation and maintenance. Funding for these facilities is included as part of the budget request in the Materials Sciences and Chemical Sciences subprograms.

The National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory is a unique user-oriented facility for advanced research with synchrotron radiation. At NSLS a wide range of research techniques are used by chemists, solid-state physicists, metallurgists, engineers and biologists for basic and applied studies. This is a forefront, dedicated facility which is used for vacuum ultra-violet and X-ray spectroscopy and X-ray scattering. This facility now serves over 3,200 users per year.

The High Flux Beam Reactor (HFBR) at Brookhaven National Laboratory produces high flux neutron beams used for research in a variety of fields. Neutrons are used as probes by solid-state physicists, chemists, and biologists. This 29 year old research reactor has been a pacesetting facility and continues to be an important research tool. When fully utilized, this facility serves nearly 200 users per year.

The Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory is a dedicated user facility for advanced research with pulsed neutrons serving the physics, materials, chemical, and life sciences research communities. About 200 user scientists conduct experiments each year.

The High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory is a multipurpose reactor used for the production of isotopes, and also used for materials sciences, nuclear chemistry, and radiation damage research. The isotopes are important to the research, medical, and industrial community. Many of these isotopes can only be produced at the HFIR reactor. When fully utilized about 200 users are involved with research at the facility. The Radiochemical Engineering Development Center is a companion facility to the HFIR and was built to recover the transuranium elements from irradiated targets from the reactor.

The Stanford Synchrotron Radiation Laboratory (SSRL) at Stanford University is a national facility funded to permit the utilization of synchrotron radiation for basic and applied research in chemistry, physics, biology, and materials sciences. This facility became independent of the operation of the High Energy Physics electron injector for the first time in 1993 and has provided significantly improved service to the users. When fully utilized about 600 users are involved in research at the facility. With some new beamlines being commissioned, especially for structural biology, increased scientific activity is expected.

The Manuel Lujan, Jr., Neutron Scattering Center (MLNSC) (formerly LANSCE) at the Los Alamos National Laboratory was being shut down in FY 1994 because Los Alamos Meson Physics Facility operations were being terminated; therefore, no FY 1995 funding was requested for this facility.

I. Major User Facilities (Cont'd)

However, because LAMPF operations will be supported by Defense Programs in FY 1996, it has been decided that the Manuel Lujan, Jr. Neutron Scattering Center will restore partial operations in FY 1996 with the proton beams being provided to the neutron spallation source.

The Combustion Research Facility (CRF) at Sandia National Laboratories, Livermore provides a unique capability to outside users from industry, university, and laboratory scientists for combustion research. The focus of the laboratory is on laser diagnostics of combustion systems, but a variety of burner systems and special facilities are available, including those for research on coal combustion and internal combustion engines. About 30 experiments involving about 60 scientists are expected to be operational in FY 1996.

The Advanced Light Source (ALS) at Lawrence Berkeley Laboratory, previously called the 1-2 GeV Synchrotron Radiation Source, is a third generation synchrotron radiation facility for intense beams of light in the UV and soft x-ray regions of the spectrum. Research will include atomic and molecular structure, corrosion, surface phenomena, chemical dynamics, imaging of biological structures, x-ray lithography, and catalysis. Operation of the user program at the ALS began in the last quarter of FY 1993 and has demonstrated extraordinary capabilities in FY 1994.

The 6-7 GeV Synchrotron Radiation Source (also known as the Advanced Photon Source (APS)) at Argonne National Laboratory will be in its final year as a construction project. Operating funds are requested for the final stages of commissioning leading up to the initial operation of this world-class facility.

II. A. Summary Table: Major User Facilities

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
National Synchrotron Light Source	$ 23,377	$ 23,491	$ 27,818	$ 4,327
High Flux Beam Reactor	21,728	21,100	24,863	3,763
Intense Pulsed Neutron Source	6,843	6,800	11,335	4,535
High Flux Isotope Reactor	25,414	24,248	28,080	3,832
Radiochemical Engineering Development Center	7,469	7,070	7,549	479
Stanford Synchrotron Radiation Laboratory	13,329	13,427	18,398	4,971
Manuel Lujan, Jr. Neutron Scattering Center	2,052	0	6,970	6,970
Combustion Research Facility	4,171	4,171	4,592	421
Advanced Light Source	21,825	21,200	29,915	8,715
6-7 GeV Synchrotron Radiation Source	52,380	64,900	82,520	17,620
Undesignated	0	1,304	0	-1,304
Total, Major User Facilities	$ 178,588	$ 187,711	$ 242,040	$ 54,329

II. B. Laboratory and Facility Funding Table: Major User Facilities

All Other	$ 178,588	$ 187,711	$ 242,040	$ 54,329
Total, Major User Facilities	$ 178,588	$ 187,711	$ 242,040	$ 54,329

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

Program Activity	FY 1994	FY 1995	FY 1996
Major User Facilities			
National Synchrotron Light Source	Continued operations with an increase to support a larger number of users. Provided upgrades in experimental systems.	Continue operations at approximately the FY 1994 level. Begin operation of small gap undulator and begin construction of elliptically polarized wiggler.	Increased funding will support enhanced operations with major instrumentation upgrades to make better use of the x-ray beams.
	$ 23,377	$ 23,491	$ 27,818
High Flux Beam Reactor	Continued operations with an increase to support a larger number of users.	Continue operations at approximately the FY 1994 level. Continue thermal hydraulic tests for 60 megawatt operation. Improve powder diffractometer and neutron reflectometer.	Increased funding will support a 60% increase in operating time and will enable many more experiments, serving many more users.
	$ 21,728	$ 21,100	$ 24,863
Intense Pulsed Neutron Source	Enhanced operations (5 additional weeks) with an increase to support a larger number of users.	Continued enhancement of operations with an increase to support a larger number of users.	Increased funding will support a 100% increase in operating time to support a much larger and growing user population.
	$ 6,843	$ 6,800	$ 11,335
High Flux Isotope Reactor	Continued operations at FY 1993 level with full attention given to ES&H upgrades.	Continues operations at approximately the FY 1994 level with full attention given to ES&H upgrades and spent fuel cask issues.	Increased funding will support a 50% increase in operating time, enabling more experiments, serving more users.
	$ 25,414	$ 24,248	$ 28,080
Radiochemical Engineering Development Center	Continued operations at approximately the FY 1994 level with full attention given to ES&H upgrades.	Continues operations at approximately the FY 1994 level with full attention given to ES&H upgrades.	Continues operations at approximately the FY 1995 level with full attention given to ES&H upgrades.
	$ 7,469	$ 7,070	$ 7,549

III. Major User Facilities (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Stanford Synchrotron Radiation Laboratory	Continued operations at FY 1993 level (approximately 6 months for users). Improvements to the SPEAR ring will be initiated.	Improvements to the SPEAR ring initiated in FY 1994 will be completed. Operation of the SPEAR ring will continue at approximately the FY 1994 level.	Increased funding will allow an increase in operating time close to 100%, providing relief to user demand. Continued improvements will be made in SPEAR as an SR source.
	$ 13,329	$ 13,427	$ 18,398
Manuel Lujan, Jr. Neutron Scattering Center	Funds provided in FY 1994 for shutdown were used to prepare the facility for potential future use, upgrade, or shutdown; e.g., inventory of assets, surveys of contaminated structures, etc. If a decision is made in the future not to operate this facility, the FY 1994 efforts would ease facility shutdown.	No activity.	Due to DOE Defense Programs support of LAMPF in FY 1996, LANSCE operations are restored.
	$ 2,052	$ 0	$ 6,970
Combustion Research Facility	Continued operations at the FY 1993 level. Strengthened programs in chemical kinetics and dynamics to accommodate more users.	Continues operations at approximately the FY 1994 level. Provides additional capability in combustion related chemical dynamics and kinetics at the CRF to accommodate more users from industrial laboratories.	Increased funding will allow operations to be enhanced to accommodate more users.
	$ 4,171	$ 4,171	$ 4,592
Advanced Light Source	Provided support for first full year of operation of the Advanced Light Source.	Continues operation of the Advanced Light Source at approximately the FY 1994 level.	Increased funding will support enhanced operation of the Advanced Light Source which will allow full utilization of existing beamlines.
	$ 21,825	$ 21,200	$ 29,915

III. Major User Facilities (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
6-7 GeV Synchrotron Radiation Source	Continued research and development, commissioning and testing of components with increases to accelerate R&D needed to support construction of the 6-7 GeV Synchrotron Radiation Source.	Continues research and development and testing of components with increases needed to begin commissioning of the storage ring.	Continues advanced commissioning of the storage ring, the insertion devices and several beamlines leading into the initial operating phase of this facility.
	$ 52,380	$ 64,900	$ 82,520
Undesignated	No activity.	Funds for Major User Facilities; this amount reduced at the appropriation level as a share of prior year balance reduction.	No activity.
	$ 0	$ 1,304	$ 0
Major User Facilities	$ 178,588	$ 187,711	$ 242,040

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
(Changes from FY 1995 Congressional Budget Request are denoted with a vertical line in left margin.)

ENERGY SUPPLY RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative dollars in whole dollars.)

IV. A. Construction Funded Project Summary

1.

Project No.	Project Title	TEC	Previous Appropriated	FY 1994 Appropriated	FY 1995 Appropriated	FY 1996 Request	Unappropriated Balance
GPE-400	General Plant Projects	$ -----	$ -----	$ 4,851	$ 4,500 a/	$ 6,314	$ -----
96-E-305	Accelerator and Reactor Improvements and Modifications, various locations	12,883	0	0	0	12,883	0
95-E-305	Accelerator and Reactor Improvements and Modifications, various locations	7,500	0	0	7,500 b/	0	0
94-E-305	Accelerator and Reactor Improvements and Modifications, various locations	7,277	0	7,277	0	0	0
	Subtotal, AIP	XXX	XXX	7,277	7,500	12,883	0
89-R-402	6-7 GeV Synchrotron Radiation Source, Argonne National Laboratory	467,178	301,799	103,814	58,379	3,186	0
87-R-405	Combustion Research Facility, Phase II, Sandia National Laboratory, Livermore	26,800	4,800	0	0	2,000	20,000
	Subtotal, Line Item Projects	XXX	XXX	103,814	58,379	5,186	20,000
	Subtotal, Basic Energy Sciences	XXX	XXX	115,942	70,379	24,383	20,000
	Adjustment for use of prior year balances	XXX	XXX	0	- 3,800	0	0
	Total, Basic Energy Sciences	$ XXX	$ XXX	$ 115,942	$ 66,579	$ 24,383	$ 20,000

a/ Does not exclude general reduction for use of prior year balances of $1,000,000.

b/ Does not exclude general reduction for use of prior year balances of $2,800,000.

IV. B. Construction Funded Project Descriptive Summary

1. Project Title and Location: Project GPE-400 General Plant Projects — TEC: $ 6,314
Various Locations — TPC: $ 6,314

Start Date: 2nd Qtr. FY 1996 Completion Date: 4th Qtr. FY 1997

2. Financial Schedule (Federal Funds):

		Costs				
Fiscal Year	Obligations	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
Prior Year Projects	XXXXX	5,443	3,081	0	0	0
1994 Projects	4,851	851	1,259	2,342	399	0
1995 Projects	3,500	0	700	1,400	1,400	0
1996 Projects	6,314	0	0	1,262	2,526	2,526

3. Narrative: This project is required to provide for minor new construction, other capital alterations and additions, and for buildings and utility systems. Where applicable, the request also includes the cost of installed capital equipment integral to a subproject. Funding of this type is essential for maintaining the productivity and usefulness of Department-owned facilities. Since it is difficult to detail this type of project in advance, a continuing evaluation of requirements and priorities may be expected to result in additions, deletions, and changes in the currently planned subprojects. The FY 1996 GPP funding for Argonne National Laboratory will also support high priority ES&H activities identified in the Department's Five Year Plan.

The currently estimated distribution of FY 1996 funds by office is as follows:

Ames Laboratory	$ 550
Argonne National Laboratory	5,369
Notre Dame Radiation Laboratory	25
Sandia National Laboratories	105
Stanford Linear Accelerator Center (SSRL)	265
Total project cost	$ 6,314

FY 1996 General Plant Projects (GPP) are miscellaneous minor new construction projects of a general nature. The total estimated costs of each will not exceed $2,000,000. Funding of this type is essential for maintaining the productivity and usefulness of Department-owned facilities and in meeting its requirement for safe and reliable facilities operation.

4. Total Project Funding (BA):

	Prior Years	FY 1994	FY 1995 a/	FY 1996 Request
Construction	$XXXXX	$ 4,851	$ 4,500	$ 6,314

a/ Does not exclude general reduction for use of prior year balances of $1,000,000.

IV. B. Construction Funded Project Descriptive Summary

1. Project Title and Location: Project 96-E-305 Accelerator and Reactor Improvements and Modifications, Various Locations — TEC: $12,883, TPC: $12,883

Start Date: 3rd Qtr. FY 1996 — Completion Date: 3rd Qtr. FY 1998

2. Financial Schedule (Federal Funds):

Fiscal Year	Appropriation	Obligations	Costs
1996	$12,883	$12,883	$ 2,575
1997	0	0	5,154
1998	0	0	5,154

3. Narrative: This project provides for additions and modifications to accelerator and reactor facilities, which are supported by the Basic Energy Sciences program. Since program priorities and needs change, the projects described below indicate the most likely projects to be funded. A continuing evaluation, however, is necessary to ensure that those projects with the greatest productivity are funded. Two projects at the Brookhaven National Laboratory are requested to incorporate improvements at the High Flux Beam Reactor and the National Synchrotron Light Source, one project is requested for facility improvements at the Stanford Synchrotron Radiation Laboratory, one project is requested at the Oak Ridge National Laboratory for improvements to the High Flux Isotope Reactor, one project at Lawrence Berkeley Laboratory is requested for improvements at the Advanced Light Source, one project is requested at Argonne National Laboratory for improvements to the Intense Pulsed Neutron Source, and one project is requested for improvements at the Kansas State University, Ion Collision Physics Facility.

The following are the projected items of work to be performed at the various locations. Since needs and priorities may change, other projects may be substituted for the examples listed below, and some of these may be located on non-Government owned property.

National Synchrotron Light Source
Consistent with the increased user requirements at the NSLS, several additions and improvements are proposed at the facility including: installation of a beamline, installation of a Spherical Grating Monochromater, and water system improvements, and major upgrades for several beamlines to replace 10-year old capabilities.

High Flux Beam Reactor
Several reactor additions and improvements are necessary to ensure the continued safe and reliable operation of this facility. Specifically in FY 1996, several projects are proposed including: Safety System Instrumentation Upgrade, Confinement Atmosphere Sampling, Reactor Vessel Periscope Replacement, and H-8 Spectrometer Improvements, and upgrades for several beamlines to enable users to collect more data.

Stanford Synchrotron Radiation Laboratory
Provides for improvements to the Stanford Synchrotron Radiation Laboratory necessary to meet changing research activities underway. The capabilities at this laboratory are an essential part of several BES research efforts, and to meet these unique requirements, modifications and improvements are necessary. During the FY 1993-FY 1995 period, a SPEAR orbit stabilization program will have improved the overall performance of the storage ring. In FY 1996 it is proposed that the ring be modified such that electron injection can be accomplished at the ring operating energy of 3 GeV.

High Flux Isotope Reactor
Provides for necessary safety improvements identified for the High Flux Isotope Reactor (HFIR) facilities and systems, to assure compliance with DOE orders and applicable standards, codes and regulations. This project will also provide for some upgrading of beamline instrumentation.

Advanced Light Source
This accelerator and reactor improvement and modification project would provide for the development of an innovative insertion device in the Light Source storage ring lattice in order to extend the generation of high-flux, high-brightness x-rays to photon energies up to at least 30 keV. This project will also provide for the beamline instrumentation to utilize the insertion device.

Kansas State University, Ion Collision Physics Facility
This project will provide a closed loop liquid nitrogen system to replace the batch filled system now in use. The liquid nitrogen compressor-refrigerator system will allow the production of liquid nitrogen for cooling of the J.R. Macdonald Laboratory superconducting LINAC and other peripheral systems. This project will also provide a new control switchyard for a more efficient operation to allow for higher yields, improved duty cycle, and quick beam identification.

Intense Pulsed Neutron Source
This project will provide for a new spallation target to increase the neutron flux available to users.

4. Total Project Funding (BA):

	FY 1996 Request
Construction	$12,883

IV. B. Construction Funded Project Descriptive Summary

1. Project Title and Location: Project 89-R-402 6-7 GeV Synchrotron Radiation Source
Argonne National Laboratory
Argonne, Illinois

TEC: $467,178
TPC: $811,922

Start Date: 3rd Qtr. FY 1990 Completion Date: 1st Qtr. FY 1997

2. Financial Schedule (Federal Funds):

Fiscal Year	Appropriated	Adjustments	Obligations	Costs
1989	$ 6,000	$ 0	$ 6,000	$ 5,633
1990	40,000	- 560 a/	39,440	15,916
1991	70,000	- 408 b/	69,592	37,347
1992	90,360	0	90,360	88,044
1993	110,407	-14,000 c/	96,407	117,504
1994	107,000	- 3,186 d/	103,814	100,104
1995	58,379	0	58,379	88,143
1996	3,186	0	3,186	14,487

a/ Reflects sequestration of funds for FY 1990.
b/ Application of a portion of the FY 1991 general reduction of $4,111,000.
c/ Application of a portion of the FY 1993 programmatic general reduction of $49,000,000.
d/ Reflects rescission of funds for FY 1994.

3. Narrative: Argonne National Laboratory is constructing a new-generation 6-7 GeV synchrotron radiation source. This facility is important for the Department's research program and will serve as a national resource for the conduct of research by industry, government, and university scientists. This facility will produce unprecedentedly brilliant x-ray beams to serve the research needs of virtually all scientific disciplines and many technological fields, e.g., physics, chemistry, materials and surface science, biology, and medicine. Users will include scientists, engineers, and graduate students from universities, industry, and research laboratories throughout the United States.

The facility as currently envisaged will consist of a large storage ring containing as many as 34 insertion devices to give intense beams of hard x-rays. The injection and booster systems will be designed to inject positrons into the storage ring at the design energy of 7 GeV. Beam currents as high as 100 milliamperes and lifetimes of at least 10 hours are anticipated. Most importantly, the lowest possible beam emittance will be sought to give the highest brilliance x-ray source by a factor of 10,000 over any in existence. This facility will impact heavily on the fields of physics, materials, chemistry, biology and medicine, and many technologies. Determination of bulk and surface structure will be performed with greater resolution and accuracy. Microprobe characterization will allow impurity detection in the parts per billion range. The high brilliance will make possible inelastic x-ray scattering which is an essentially unexplored field. Investigating time-dependent phenomena in biological membranes and in photosynthetic processes will be possible, as will observing the motion of atoms in protein systems. Angiography and analysis of tumor diseases will be advanced through non-invasive and very fast x-ray diagnostics without, or with the minimal use of, dyes or drugs. Topography will be extended to time-resolved studies of plastic deformation and fracture. All of these investigations are made possible by the photon energy, time-structure, intensity, and unusual brilliance of the radiation source. Other experiments important to national security needs would also be undertaken.

4. Total Project Funding (BA):

	Prior Years	FY 1994	FY 1995	FY 1996 Request	To Complete
Construction	$301,799	$103,814	$58,379	$ 3,186	$ 0
Capital Equipment	15,800	5,642	3,900	7,258	0
Operating Expenses	105,022	52,380	64,900	82,520	7,322

IV. B. Construction Funded Project Descriptive Summary

1. Project Title and Location: Project 87-R-405 Combustion Research Facility, Phase II
Sandia National Laboratories
Livermore, California

TEC: $ 26,800
TPC: $ 30,020

Start Date: 4th Qtr. FY 1988 Completion Date: 4th Qtr. FY 1999

2. Financial Schedule (Federal Funds):

Fiscal Year	Appropriated	Obligations	Costs
Prior Years	$ 4,800	$ 4,800	$ 4,205
1995	0	0	450
1996	2,000	2,000	1,700
1997	9,000	9,000	9,400
1998	7,000	7,000	6,800
1999	4,000	4,000	4,245

3. Narrative: Sandia National Laboratories, Livermore (SNL/L) is constructing an addition of approximately 32,300 square feet to the existing 51,100 square-foot multibuilding CRF facility (Project No. 78-13-B, TEC $9.4 million) at SNL/L. Phase II will add 21,200 square feet to the existing 16,400 square-foot laboratory building and 11,100 square feet to the existing 25,000 square-foot office building. This project will add vitally needed capacity and important new capabilities to the Combustion research resources that can adequately deal with the critical needs of the 1990s. During the past 10 years, the number of scientists who visit CFR to participate in research has almost tripled, completely saturating CRF, Phase I facilities. To accomplish this goal requires the addition of a new laboratory wing that emphasizes centralized next-generation laser diagnostic facilities and specially designed laboratories not available in CRF Phase I.

The project has been delayed due to severe budget constraints during FY 1989 through FY 1995. The appropriations totaling $4.8 million in FY 1987 and FY 1988 were used for site preparation and design and construction of the shell of the laboratory building addition. The appropriations in FY 1996-FY 1999 will complete the balance of the project.

The overall scope of this project is the doubling of space available for experiments. Equipment funds are required for a new central laser system and special purpose laboratory equipment. A modest enlargement of the office building is included to house the rapidly increasing population of visiting scientists. These enhancements will consolidate the combustion-related resources at a single site readily accessible to visiting scientists.

4. Total Project Funding (BA):

	Prior Years	FY 1996 Request	To Complete
Construction	$4,800	$ 2,000	$20,000
Capital Equipment	0	0	2,000
Operating Expenses	220	0	1,000

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST

ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

Basic Energy Sciences

1. Title and Location of Project: General Plant Projects
Various Locations

2a. Project No. GPE-400
2b. Construction Funded

3a. Date A-E Work Initiated, (Title I Design Start Scheduled): 1st Qtr. FY 1996

3b. A-E Work (Title I & II) Duration: Months vary per project

4a. Date Physical Construction Starts: 2nd Qtr. FY 1996

4b. Date construction ends: 4th Qtr. FY 1997

5. Previous Cost Estimate: None

6. Current Cost Estimate:
TEC -- $6,314
TPC -- $6,314

7. Financial Schedule (Federal Funds):

Fiscal Year	Obligations	Costs				
		FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
Prior Year Projects	$ XXXXX	$ 5,443	$ 3,081	$ 0	$ 0	$ 0
1994 Projects	4,851	851	1,259	2,342	399	0
1995 Projects	3,500	0	700	1,400	1,400	0
1996 Projects	6,314	0	0	1,262	2,526	2,526

8. Brief Physical Description of Project

This project is required to provide for minor new construction, other capital alterations and additions, and for buildings and utility systems. Where applicable, the request also includes the cost of installed capital equipment integral to a subproject. Funding of this type is essential for maintaining the productivity and

1. Title and Location of Project: General Plant Projects

2a. Project No. GPE-400
2b. Construction Funded

8. Brief Physical Description of Project (Continued)

usefulness of Department-owned facilities. Since it is difficult to detail this type of project in advance, a continuing evaluation of requirements and priorities may be expected to result in additions, deletions, and changes in the currently planned subprojects. In general, the estimated funding for each location is preliminary in nature, and is intended primarily to indicate the relative magnitude of the requirements. No significant R&D program is anticipated as a prerequisite for design and construction of the subprojects under construction. The FY 1996 GPP funding for Argonne National Laboratory will also support high priority ES&H activities identified in the Department's Five Year Plan.

The currently estimated distribution of FY 1996 funds by laboratory is as follows:

Ames Laboratory	$ 550
Argonne National Laboratory	5,369
Notre Dame Radiation Laboratory	25
Sandia National Laboratories	105
Stanford Linear Accelerator Center (SSRL)	265
Total project cost	$ 6,314

9. Purpose, Justification of Need For, and Scope of Project

The following are examples of the major items to be performed at the various locations. Since needs and priorities may change, other projects may be substituted for the examples listed below, and some of these may be located on non-Government owned land.

Ames Laboratory ..... $ 550

Includes funds to maintain the research capability at the Ames Laboratory, to adapt the facilities to changes required to meet new and improved production techniques, to effect economies of operations, and to reduce or eliminate health, fire, safety or environmental problems. The major projects are the fume hood/ventilation upgrade, handicapped access modifications and Spedding Hall elevator replacement. The highest priorities will be selected based on the laboratory and DOE assessment of existing environmental, health, and safety needs at the laboratory. The projects described above will be constructed on Government-owned buildings located on non-Government owned land at the Ames Laboratory.

1. Title and Location of Project: General Plant Projects	2a. Project No. GPE-400 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of Project (Continued)

Argonne National Laboratory..... $ 5,369

The Argonne National Laboratory FY 1995 General Plant Projects (GPP) are miscellaneous minor new construction projects of a general nature (such as safety upgrades, fire protection upgrades, and shower and lavatory upgrades). The total estimated costs of each will not exceed $2,000,000. These general plant projects are required to provide for minor new construction and additions, and upgrades for buildings and utility systems. Where applicable, the request also includes the cost of installed capital equipment integral to a subproject. Funding of this type is essential for maintaining the productivity and usefulness of Department-owned facilities and in meeting its requirements for safe and reliable facilities operation. Since it is difficult to detail this type of project in advance, a continuing evaluation of requirements and priorities may be expected to result in additions, deletions, and modifications to the currently planned subprojects. No significant R&D program is anticipated as a prerequisite for design and construction of the subprojects under construction. The highest priority projects will be selected as needs are identified in FY 1996.

Notre Dame Radiation Laboratory..... $ 25

The Radiation Laboratory is housed in the Radiation Research Building, a Government-owned building located on non-Government-owned land on the campus of the University of Notre Dame. The area to be modified is within the Radiation Research Building. After the Laboratory's old LINAC is decommissioned, the vault in which it resides will be converted to a laser spectroscopy laboratory. This will alleviate congestion and scheduling problems in another laser laboratory. Necessary modifications include removal of hardware associated with LINAC installation and/or modification of plumbing, electrical and light fixtures consistent with new usage, and installation of suitable cabinetry.

Sandia National Laboratories..... $ 105

The Combustion Research Facility (CRF) at Sandia National Laboratories, Livermore (SNL/L) has a continuing need for General Plant Project (GPP) funds for upgrading or the construction of facilities as required to meet expanding or continuously changing programmatic goals and to meet identified environmental, health, and safety requirements. This project will provide funding to modify laboratory space and facilities in the CRF Laboratory Complex. Modifications will be needed to accommodate the many active and proposed combustion research experiments whose needs continuously change and have become increasingly complex because of the technological advances in combustion research. Additional modifications are mandated for environmental, safety and health needs that have evolved since the original facility was designed in 1977.

1. Title and Location of Project: General Plant Projects	2a. Project No. GPE-400 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of Project (Continued)

Stanford Linear Accelerator Center (SSRL)..... $ 265

Requirements include minor modifications and additions necessary to support the optimum use of the laboratory research capabilities and to meet identified environmental, health, and safety requirements. These improvements are necessary to maintain the capital investment at the site, to keep the backlog of projects from growing, and to accommodate the continuous changes to the physical makeup of the site necessitated by the evolving SSRL research projects. Examples include upgrading of laboratory space, modifications to roads and parking areas, and relocation of experimental equipment at the facility. The projects described will be constructed on Government-owned SSRL buildings located on Stanford University non-Government owned land.

10. Details of Cost Estimate

See description, item 8. The estimated costs are preliminary and, in general indicate the magnitude of each program. These costs included engineering, design, construction and inspection.

11. Method of Performance

Design will be on the basis of negotiated architect-engineer contracts. To the extent feasible, construction and procurement will be accomplished by firm fixed-price contracts and subcontracts awarded on the basis of competitive bidding.

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST

ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

Basic Energy Sciences

1. Title and Location of Project: Accelerator and Reactor Improvements and Modifications, various locations

2a. Project No. 96-E-305
2b. Construction Funded

3a. Date A-E Work Initiated, (Title I Design Start Scheduled): 1st Qtr. FY 1996

3b. A-E Work (Title I & II) Duration: Months vary per project

4a. Date Physical Construction Starts: 3rd Qtr. FY 1996

4b. Date Construction Ends: 3rd Qtr. FY 1998

5. Previous Cost Estimate: None

6. Current Cost Estimate:
TEC -- $12,883
TPC -- $12,883

7. Financial Schedule (Federal Funds):

Fiscal Year	Appropriation	Obligations	Costs
1996	$12,883	$12,883	$ 2,575
1997	0	0	5,154
1998	0	0	5,154

8. Brief Physical Description of Project

This project provides for additions and modifications to accelerator and reactor facilities, which are supported by the Basic Energy Sciences program. Since program priorities and needs change, the projects described below indicate the most likely projects to be funded. A continuing evaluation, however, is necessary to ensure that those projects with the greatest productivity are funded. Two projects at the Brookhaven National Laboratory are requested to incorporate improvements at the High Flux Beam Reactor and the National Synchrotron Light Source, one project is requested at the Stanford Linear Accelerator for facility improvements at the Stanford Synchrotron Radiation Laboratory, one project is requested at the Oak Ridge National Laboratory for improvements to the High Flux Isotope Reactor, one project is requested at the Lawrence Berkeley Laboratory for improvements at the Advanced Light Source, one project is requested at Argonne National Laboratory for improvements to the Intense Pulsed Neutron Source, and one project is requested for improvements at the Kansas State University Ion Collision Physics Facility.

1. Title and Location of Project:	Accelerator and Reactor Improvements and Modifications, various locations	2a. Project No. 96-E-305 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of the Project

The following are the projected items of work to be performed at the various locations. Since needs and priorities may change, other projects may be substituted for the examples listed below, and some of these may be located on non-Government owned property.

a. National Synchrotron Light Source (BNL)..... $ 2,900

Consistent with the increased user requirements at the NSLS, several additions and improvements are proposed at the facility including: installation of a beamline, installation of a Spherical Grating Morochromator, and water system improvements, and major upgrades for several beamlines to replace 10-year old capabilities.

b. High Flux Beam Reactor (BNL)..... $ 3,800

Several reactor additions and improvements are necessary to ensure the continued safe and reliable operation of this facility. Specifically in FY 1996, several projects are proposed: Safety System Instrumentation Upgrade, Confinement Atmosphere Sampling, Reactor Vessel Periscope Replacement, and H-8 Spectrometer Improvements, and upgrades for several beamlines to enable users to collect more data.

c. Stanford Synchrotron Radiation Laboratory (SLAC)..... $ 465

This project will provide for improvements at the Stanford Synchrotron Radiation Laboratory necessary to meet changing research activities underway. The capabilities at this laboratory are an essential part of several BES research efforts, and to meet these unique requirements, modifications and improvements are necessary. During the FY 1993-FY 1995 period, a SPEAR orbit stabilization program will have improved the overall performance of the storage ring. In FY 1996, it is proposed that the ring be modified such that electron injection can be accomplished at the ring operating energy of 3 GeV. This will eliminate the requirement to inject at a lower energy and "ramp up" to the desired operating energy, thereby providing for faster filling and insuring the fill-to-fill reproducibility of the electron beam orbits.

1. Title and Location of Project:	Accelerator and Reactor Improvements and Modifications, various locations	2a. Project No. 96-E-305 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of the Project (Continued)

d. High Flux Isotope Reactor (ORNL)..... $ 1,200

The purpose of this project is to improve the safety of the HFIR and to assure compliance with DOE orders and with applicable standards, codes and regulations. Current instrumentation used in three systems for monitoring and controlling reactor power level is "original HFIR" and is far out of date. Due to their age, these instrumentation systems are difficult to maintain because of the non-availability of spare parts and services, and calibration is inaccurate and subject to excessive drifting. Funding is being provided to replace them. This project will also provide for some upgrading of beamline instrumentation.

e. Advanced Light Source (LBL)..... $ 3,675

This accelerator and reactor improvement and modification project would provide for the development of an innovative insertion device in the Light Source storage ring lattice in order to extend the generation of high-flux, high-brightness x-rays to photon energies up to at least 30 keV. The extended spectral ring would enhance the scope of the Light Source scientific program by providing higher photon energies than now available without sacrificing the limited number of straight sections that are best utilized by very-high-brightness undulator VUV and soft x-ray sources, thereby increasing the Light Source contribution to the nation's scientific, technical, and education base. This project will also provide for the beamline instrumentation to utilize the insertion device which will provide a significant increase in the experimental capability for users.

f. Kansas State University, Ion Collision Physics Facility..... $ 493

This project will provide a closed loop liquid nitrogen system to replace the batch filled system now in use. The liquid nitrogen compressor-refrigerator system will allow the production of liquid nitrogen for cooling of the J.R. Macdonald Laboratory superconducting LINAC and other peripheral systems. This project will also provide a new control switchyard for a more efficient operation to allow for higher yields, improved duty cycle, and quick beam identification.

1. Title and Location of Project:	Accelerator and Reactor Improvements and Modifications, various locations	2a. Project No. 96-E-305 2b. Construction Funded

g. Intense Pulsed Neutron Source (ANL)..... $ 350

This project will provide for a new spallation target to increase the neutron flux available to users.

10. Details of Cost Estimate

a. Engineering, design, and inspection and component assembly and installation.....	$12,883
Total line item cost.....	$12,883

11. Method of Performance

Design, engineering and inspection will be performed by Argonne National Laboratory, Brookhaven National Laboratory, Stanford Synchrotron Radiation Laboratory, Oak Ridge National Laboratory, and Lawrence Berkeley Laboratory. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts and subcontracts awarded on the basis of competitive bidding.

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
(Changes from FY 1995 Congressional Budget Request are denoted with a vertical line in left margin.)

ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

Basic Energy Sciences

1. Title and Location of Project: 6-7 GeV Synchrotron Radiation Source, Argonne National Laboratory, Argonne, Illinois
2a. Project No. 89-R-402
2b. Construction Funded

3a. Date A-E Work Initiated (Title I Design Start Scheduled): 2nd Qtr. FY 1989
3b. A-E Work (Titles I & II) Duration: 48 months

5. Previous Cost Estimate:
Total Estimated Cost (TEC) -- $467,178
Total Project Cost (TPC) -- $811,922

4a. Date Physical Construction Starts: 3rd Qtr. FY 1990
4b. Date Construction Ends: 1st Qtr. FY 1997

6. Current Cost Estimate:
TEC -- $467,178
TPC -- $811,922

7. Financial Schedule (Federal Funds):

Fiscal Year	Appropriation	Adjustments	Obligations	Costs
1989	$ 6,000	$ 0	$ 6,000	$ 5,633
1990	40,000	- 560 a/	39,440	15,916
1991	70,000	- 408 b/	69,592	37,347
1992	90,360	0	90,360	88,044
1993	110,407	-14,000 c/	96,407	117,504
1994	107,000	- 3,186 d/	103,814	100,104
1995	58,379	0	58,379	88,143
1996	3,186		3,186	14,487

a/ Reflects sequestration of funds for FY 1990.
b/ Application of a portion of the FY 1991 general reduction of $4,111,000.
c/ Application of a portion of the FY 1993 programmatic general reduction of $49,000,000.
d/ Reflects rescission of funds for FY 1994.

1. Title and Location of Project:	6-7 GeV Synchrotron Radiation Source Argonne National Laboratory Argonne, Illinois	2a. Project No. 89-R-402 2b. Construction Funded

8. Brief Physical Description of Project

The DOE has selected Argonne National Laboratory to design and build a new generation 6-7 GeV synchrotron radiation source. This facility is important for the Department's research program and will serve as a national resource for the conduct of research by industry, government, and university scientists. This facility will be located at the Argonne National Laboratory and will produce unprecedentedly brilliant x-ray beams to serve the research needs of virtually all scientific disciplines and many technological fields, e.g., physics, chemistry, materials and surface science, biology, and medicine. Users will include scientists, engineers, and graduate students from universities, industry, and research laboratories throughout the United States.

The accelerator complex will consist of a 200 MeV electron accelerator, a positron production target, a positron linac, a positron accumulator ring, an injector synchrotron to accelerate positrons to 6-7 GeV, and a positron storage ring. The storage ring will be housed in an annular building and will provide space for 69 experimental beamlines and related equipment. Funding for an initial complement of beamlines is included in this construction project. The injector synchrotron will be housed in a separate, but related, structure. The complex will also include: offices; general and special purpose laboratories; clean room laboratories; and miscellaneous service operations areas. Provisions are included for site access roads, parking, service utilities, and miscellaneous site amenities.

The central lab/office building will contain laboratories, administrative offices, library and technical areas with an associated multiuse meeting facility.

The following is a brief physical description of the project facilities:

TECHNICAL COMPONENTS: The major system components for the production and injection of positrons are of conventional design. The storage ring, with approximately a 1100-meter circumference and 40 6-meter-long straight sections, is so designed that the positron beam size and position at each insertion device can be tuned independently for optimal performance. Storage ring magnets are of conventional design; however, a novel and highly effective vacuum system is proposed. The storage ring will operate at an energy (6-7 Gev) which will assure that 20 keV x-rays can be effectively obtained from an undulator in the fundamental mode.

1. Title and Location of Project:	6-7 GeV Synchrotron Radiation Source Argonne National Laboratory Argonne, Illinois	2a. Project No. 89-R-402 2b. Construction Funded

8. Brief Physical Description of Project (Continued)

Of the 40 straight sections, 6 will be occupied by accelerator equipment. Thus a total of 34 straight sections are available for insertion devices (undulators and wigglers). In addition, 35 photon beams from bending magnets (BM) can be provided. The initial complement of beamlines included directly in the project are based on three different types of radiation sources. Additional beamlines, as provided through Collaborative Access Teams (CAT's), are also expected to be ready at commissioning.

CONVENTIONAL FACILITIES: The central laboratory/office building is a conventionally designed building with structural steel framing, concrete floor slabs, and an architectural metal exterior curtain wall with insulated glass windows. The office/laboratory section is composed of two connected four story buildings with mechanical penthouses. An adjacent building houses a multipurpose meeting facility designed for seminars and user meetings. The accelerator control center is located in a two story building attached to the experimental hall building near the central laboratory/office building.

The heating, ventilation and air-conditioning systems are generally variable volume, constant temperature air supply systems providing standard temperature and humidity conditions. Computer rooms and laboratory clean rooms have separate specialized air-handling systems. The building's fire-protection system consists of smoke-detectors, sprinkler systems, and alarm-controlled zones electronically interlocked with Argonne's site-wide fire and security system. Utility systems are conventional, interconnecting with Argonne's existing site-wide utility system.

Conventional facilities buildings for injection consist of the linear accelerator/klystron gallery wing, the synchrotron injection wing, the synchrotron extraction wing, and the synchrotron ring tunnel.

(1) The linear accelerator/klystron gallery building is a long, narrow structure having an outer shell similar to a prefabricated metal building and joined on one side by a reinforced concrete and earth-shielded linear accelerator tunnel. The klystron gallery is an open bay with concrete floor slab, steel frame, and metal panel walls.

(2) The synchrotron injection wing is similar to a prefabricated metal building. Appropriate shielding is provided by concrete blocks.

1. Title and Location of Project:	6-7 GeV Synchrotron Radiation Source Argonne National Laboratory Argonne, Illinois	2a. Project No. 89-R-402 2b. Construction Funded

8. Brief Physical Description of Project (Continued)

(3) The synchrotron extraction tunnel is located below the rf/extraction ring. Appropriate shielding is provided by concrete walls and roof.

(4) The synchrotron enclosure is a box shaped reinforced concrete structure which provides approximately two feet of cover over the top and having sloped sides.

The experimental hall/storage ring building is an annular shaped, metal clad building having an average radius of 600 feet, and is approximately 28 feet high and 85 feet wide. Steel columns and 120 roof beams provide a clear span for experimental beamline installation. A concrete "storage ring" shielding enclosure is located within the building near the inner wall. This enclosure has approximately 3-foot thick reinforced concrete walls and roof slab. The inside height is 9 feet and the width varies between about 9 and 21 feet in a sawtooth pattern.

The experimental hall building has separate air-handling units and air-distribution units creating multiple zones to provide heat and air-conditioning. The storage ring enclosure is air-conditioned and exhausted to the extent necessary to remove equipment-generated heat only. All utilities are distributed to the building from the utility support building.

An emergency/service vehicle tunnel, 14 foot head clearance, is provided under the building for infield access. A pedestrian tunnel also connects central laboratory/office building to the control room, crosses the experimental hall, and connects the rf/extraction and injector buildings.

An rf/extraction building, located above the synchrotron extraction tunnel, will house storage-ring magnet powersupplies and radio frequency (rf) equipment for the synchrotron and the storage ring. Consistent with user needs, at least four laboratory/office modules will be constructed. These are similar metal-framed one-story buildings with insulated metal exterior panels and concrete floor slabs. These buildings are spaced at intervals around the outside of the experimental hall/storage ring building and each contains offices, laboratories, conference areas, service support spaces, and truck air-lock access to facilitate delivery of technical components.

1. Title and Location of Project:	6-7 GeV Synchrotron Radiation Source Argonne National Laboratory Argonne, Illinois	2a. Project No. 89-R-402 2b. Construction Funded

8. Brief Physical Description of Project (Continued)

The utility support facility houses central mechanical and electrical equipment supporting the accelerator components and conventional facilities. It is a single-story, conventional metal-framed structure similar to a prefabricated metal building, with reinforced concrete floor slab. The facility has an overhead truck access door.

SITE IMPROVEMENTS: The completed project will occupy approximately 80 acres of relatively level, open land on the Argonne site. A standard perimeter road encircling the entire complex will provide access to all quadrants and interconnect with Argonne's road system. The project center and the four office/laboratory modules will have paved parking facilities. Emergency and service access to the infield area of the experimental hall/storage ring will be via a 16-foot wide vehicle tunnel.

9. Purpose, Justification of Need For, and Scope of Project

Over the past 20 years, synchrotron radiation emitted by circulating electron or positron beams has emerged as a very powerful and versatile source of vacuum ultraviolet light and x-rays, and a very powerful tool for probing the structure of matter and for studying various physical processes. Several synchrotron radiation facilities with different designs and characteristics are now in regular operation in this country, the most recent additions being the 0.8 GeV and 2.5 GeV rings of the National Synchrotron Light Source at Brookhaven National Laboratory.

In October of 1983, an ad hoc committee was convened by the Department of Energy, Office of Basic Energy Sciences, with the charter to "solicit and evaluate ideas from synchrotron-radiation providers and users as to the future opportunities and technical needs for synchrotron-radiation based research." The committee had a membership of 17 scientists actively pursuing research using synchrotron radiation. The finding of the committee, briefly stated, is that the present research and development programs in materials science, physics, biology, and chemistry using

1. Title and Location of Project:	6-7 GeV Synchrotron Radiation Source Argonne National Laboratory Argonne, Illinois	2a. Project No. 89-R-402 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of Project (Continued)

synchrotron radiation can be greatly benefitted by the availability of two additional facilities in the U.S. The one with the higher priority is a high-energy storage ring capable of providing fundamental undulator radiation in the x-ray region of the spectrum up to 20 keV, with an early 1990 target date for full operation. Such a storage ring requires an electron or positron beam of energy around 6-7 GeV. Both should be insertion device (undulator and wiggler) based machines designed to accommodate a large number of such insertion devices.

The recommendation by the Committee was later studied and endorsed by the Major Materials Facilities Committee of the National Academy of Sciences and the top priority for the 6 GeV facility was strongly reaffirmed. This high priority national need was reaffirmed in the National Research Council (Brinkman) report - "Physics through 1990's" - and by the Stehle subcommittee of the DOE Energy Research Council Advisory Board.

During 1986 a National task group recommended that the synchrotron energy should be increased from the previously specified value of 6 GeV in order to provide wider tunability of x-rays from undulator sources. Based on the report of that task group, 7 GeV has been chosen as the standard operating energy of the synchrotron. This document addresses the proposed construction of this new synchrotron radiation facility. This new facility will consist of a large storage ring containing as many as 34 insertion devices to give intense beams of hard x-rays. The injection and booster systems will be designed to inject positrons into the storage ring at the design energy of 7 GeV. Beam currents as high as 100 milliamperes and lifetimes of at least 10 hours are anticipated. Most importantly, the lowest possible beam emittance would be sought to give the highest brilliance x-ray source by a factor of 10,000 over any in existence. This facility would impact heavily on the field of physics, materials, chemistry, biology and medicine, and many technologies. Determination of bulk and surface structure will be performed with greater resolution and accuracy. Microprobe characterization will allow impurity detection in the parts per billion range. The high brilliance will make possible inelastic x-ray scattering which is an essentially unexplored field. Investigating time-dependent phenomena in biological membranes and in photosynthetic processes will be possible, as will observing the motion of atoms in protein systems. Angiography and analysis of tumor diseases will be advanced through non-invasive and very fast x-ray diagnostics without, or with the minimal use of, dyes or drugs. Topography will be extended to time-resolved studies of plastic deformation and fracture. All of these investigations are made possible by the photon energy, time-structure, intensity, and unusual brilliance of the radiation source. Other experiments important to national security can also be undertaken.

1. Title and Location of Project:	6-7 GeV Synchrotron Radiation Source Argonne National Laboratory Argonne, Illinois	2a. Project No. 89-R-402 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of Project (Continued)

Research and development funding will be used to refine the lattice design of the storage ring, design and test new radio-frequency cavity systems, advance vacuum technology and surface cleaning techniques, develop insertion devices, and investigate beamline components that must handle greater x-ray intensities than at existing sources.

Reliability, stability, and flexibility are emphasized in the accelerator, storage ring, and beamline designs. Specifically, the storage ring can accommodate all types of insertion devices with all tuning conditions desired by the users.

10. Details of Cost Estimate

	Total Cost
a. 1. Engineering, design, and inspection	$ 61,735
2. Construction management costs	11,910
b. Construction costs	
1. Technical components	209,571
2. Conventional facilities	136,632
Subtotal	419,848
c. Contingency	47,330
Total line item cost	$467,178

11. Method of Performance

Customary accepted practice will be followed. Design of the conventional facilities will be performed under a CPFF architect/engineer contract awarded in accordance with established DOE approved procedures. The design of technical components will be performed by the Laboratory. To the extent feasible, construction and other procurements will be by means of fixed price contracts awarded on the basis of competitive bidding.

1. Title and Location of Project: 6-7 GeV Synchrotron Radiation Source
Argonne National Laboratory
Argonne, Illinois

2a. Project No. 89-R-402
2b. Construction Funded

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	Total
a. Total project funding									
1. Total facility costs									
(a) Line item (Sec. 10)	$21,549	$37,347	$ 88,044	$117,504	$100,104	$ 88,143	$14,487	$ 0	$ 467,178
(b) Expense funded equipment.	0	0	0	0	0	0	0	0	0
(c) Inventories	0	0	400	4,000	2,813	1,300	87	0	8,600
Total direct cost	21,549	37,347	88,444	121,504	102,917	89,443	14,574	0	475,778
2. Other project costs									
(a) R&D necessary to complete construction	26,798	14,332	17,265	21,626	14,932	7,500	0	0	102,453
(b) Other project related costs	0	0	6,115	11,021	34,635	56,100	82,433	7,322	197,626
(c) Capital equipment	3,800	1,500	1,500	9,000	5,642	3,900	7,258	0	32,600
(d) Conceptual design costs	3,465	0	0	0	0	0	0	0	3,465
Total other project costs	34,063	15,832	24,880	41,647	55,209	67,500	89,691	7,322	336,144
Total project cost (TPC) (Items 1 & 2)	$55,612	$53,179	$113,324	$163,151	$158,126	$156,943	$104,265	$7,322	$811,922

b. Related annual funding a/ (estimated life of project: 20 years)

1. Facility operating costs b/	$61,000
2. Programmatic research	19,000
3. ES&H Costs	6,100
4. Maintenance Costs c/	2,000
5. Capital equipment related to programmatic research	2,625
6. Accelerator improvements	4,725
Total related annual funding	$95,450

a/ Estimated costs in thousands escalated to 1997-year dollars.
b/ Annual operating costs which begin in 1997 include operations effort, utility, and administrative costs.
c/ Maintenance cost estimated at 2.5% of annual operating cost in FY 1997, building to 7% by FY 2000.

1. Title and Location of Project:	6-7 GeV Synchrotron Radiation Source Argonne National Laboratory Argonne, Illinois	2a. Project No. 89-R-402 2b. Construction Funded

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding

1. Total facility costs

(a) Construction line item - No narrative required

(b) Inventories

The spare parts inventory consists of specialized technical components which are not readily available "off the shelf" and have long lead times for procurement. These components include items such as rf accelerating cavities, klystrons, magnets, and beam diagnostic apparatus.

2. Other project costs

(a) R&D necessary to complete construction.

These costs represent the R&D necessary to assure the best possible performance of the facility, to optimize conceptual engineering designs, and to develop the quality assurance plans for the testing of all hardware. The R&D plan includes: accelerator physics, including optimization of the current lattice and studies of alternative lattices, tracking with component errors and misalignments, nonlinear effects of the lattice and insertion devices, and vacuum chamber impedances; component prototyping and testing; designs for insertion devices and beamline components; detector development; and reexamination of the designs for the conventional facilities.

(b) Related annual funding

These costs provide support for staff, utilities, management, start-up, commissioning, and pre-operations R&D for the APS. This support starts in FY 1992 with the commissioning of the linac and continues in FY 1993 through FY 1996, to include the Positron Accumulator Ring, the Booster Synchrotron, the Storage Ring and beamlines. In late FY 1996, the monthly cost profile for the 6-7 GeV should be the same as for a fully operational 6-7 GeV.

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST

ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

Basic Energy Sciences

1. Title and Location of Project: Combustion Research Facility, Phase II
Sandia National Laboratories
Livermore, California

2a. Project No. 87-R-405
2b. Construction Funded

3a. Date A-E Work Initiated, (Title I Design Start Scheduled): 1st Qtr., FY 1988

3b. A-E Work (Titles I & II) Duration : 12 months

5. Previous Cost Estimate:
Total Estimated Cost (TEC) -- $23,300
Total Project Cost (TPC) -- $23,520

4a. Date Physical Construction Starts: 4th Qtr., FY 1988

4b. Date Construction Ends: 4th Qtr., FY 1999

6. Current Cost Estimate:
TEC -- $26,800
TPC -- $30,020

7. Financial Schedule (Federal Funds):

Fiscal Year	Appropriation	Obligations	Costs
Prior Years	$ 4,800	$ 4,800	$ 4,205
1995	0	0	450
1996	2,000	2,000	1,700
1997	9,000	9,000	9,400
1998	7,000	7,000	6,800
1999	4,000	4,000	4,245

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

8. Brief Physical Description of Project

Phase II of the Combustion Research Facility (CRF) will add approximately 32,300 gross square feet to the existing 51,100 square-foot multibuilding CRF facility (Project No. 78-13-B, TEC $9.4 million) at Sandia National Laboratories, Livermore (SNL/L). Phase II will add 21,200 square feet to the existing 16,400 square-foot laboratory building and 11,100 square feet to the existing 25,000 square-foot office building. The project will include such site modifications and improvements as yard paving, walkways, landscaping, fencing, signage, and east entrance road relocation.

The project has been delayed due to budget constraints from FY 1989 through FY 1995. The appropriations totaling $4.8 million in FY 1987 and FY 1988 were used for site preparation and design and construction of the shell of the laboratory building addition. The appropriations in FY 1996-FY 1999 will complete the balance of the project.

The laboratory building addition will be an L-shaped extension to the south and east of the existing building. Construction of the addition will match the existing building in architectural style, materials, and finishes, color, and floor-to-floor heights. The structure of the building will be steel framed with precast exterior concrete shear walls (insulated), slab-on-grade floors designed for dampening and vibration isolation, steel-framed louver enclosed mechanical loft above the laboratories with metal and concrete deck (insulated), and a loft roof consisting of built-up roofing on metal decking. The laboratory building addition will provide sixteen new laboratory spaces and two facility laser laboratories. The new facility laser rooms will be connected to serve any Lab in the facility, via the Laser Duct and Periscope System. Laboratory spaces of varied sizes are planned to provide optimum flexibility of spaces as required to operate the various experiments intended for this facility. Partitions around most laboratories will be floor-to-loft deck metal stud with gypsum board, designed for sound attenuation. Partitions around three high-bay laboratories will be poured-in-place concrete extending from the floor up through the loft deck to the loft roof above. Free-standing acoustical partitions along the main corridor will enclose some work spaces, accommodating remote data acquisition and control equipment outside the laboratories. All interior walls will be painted. Floors throughout the laboratory spaces, laboratory work areas, and corridors will be finished with resilient floor tile, while the floors in the main entry vestibule will be finished with carpet tile. Suspended acoustical ceilings will be provided except in high-bay laboratories.

Once-through conditioned ventilation will be provided from existing building fans for existing and new laboratory spaces to carry off fuel gases or vapors and products of combustion, with systems included to minimize the discharge of contaminants to the atmosphere. An electronic safety monitoring and control system will provide back-up to the ventilation system.

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

8. Brief Physical Description of Project (Continued)

Recirculated conditioned ventilation will be provided from a new fan system to the corridor and work spaces outside the laboratories in both the existing and new addition. The existing system of ducts used for diagnostic laser beam transmission from the central laser rooms will be extended to all new laboratories. Other existing building systems such as power distribution, lighting, communications, security alarms, fire and evacuation alarms, automatic fire sprinkler, and piping and plumbing will also be extended to the addition.

The office building addition will provide space for thirty-four new offices, an open office secretarial and file area, computer terminal rooms, and conference rooms. The addition will be a two-story wing added to the north of the existing office building and will match it in architectural style, materials and finishes, color, and floor-to-floor height. It will consist of a steel-framed structure with metal panel curtain walls, slab-on-grade floors at the ground level, second floor cellular metal decking with concrete fill, and an insulated metal deck roof with built-up roofing. It will also include an exterior emergency exit stairwell, solar insulated glass at the exterior windows, metal stud with painted gypsum board interior partitions, free-standing acoustical partitioning around open office areas, suspended acoustical ceilings, and carpet-tiled floors. The existing building main stairwell will be modified to accommodate the increased traffic due to added office space. Roof-mounted air handling equipment will provide heating, ventilating, and air conditioning. An automatic sprinkler system, general and emergency lighting, electrical power distribution, communication systems, intrusion alarms, and fire and evacuation alarms will be provided.

Design of the existing mechanical building allowed space for the expansion of some services. Included in this project will be an additional chiller, pumps, and heat exchangers. Additional fan equipment providing recirculated conditioned air for the laboratory building and its addition will be in the loft space above the laboratory buildings. An additional electrical substation and process-cooling water system will also be provided.

Existing site utilities such as domestic and fire protection water, sanitary sewer, natural gas, site lighting, and electrical power and special systems will be modified and extended to service the additional facilities.

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

8. Brief Physical Description of Project (Continued)

A key feature of the Combustion Research Facility is the availability of specially designed lasers for optical diagnostics. The Facility lasers developed in Phase I will continue to be used, and will be supplemented by two new Facility lasers: a high-power pulsed, high-repetition rate tunable ultraviolet laser (UV) and a subpicosecond laser capability. The laser beam directing system will be extended so that the existing and new laboratories have the capability of receiving the beam from any of the Facility lasers.

Other equipment includes a gas-chromatograph-mass spectrometer, infrared, visible, and ultraviolet spectrometers, elemental analyzers, optical signal processing equipment, and fast laser image processing devices.

Existing equipment from current facilities at SNL/L will be relocated to eleven of the new labs, although some of these experiments will be modified and some equipment will be upgraded. Two labs will be furnished with new equipment within the project TEC, and three labs will be furnished with new equipment by future users of the facilities.

9. Purpose, Justification of Need For, and Scope of Project

This project will add vitally needed capacity and important new capabilities to the Combustion Research Facility at SNL, Livermore. The principal objective of this construction is to provide combustion research resources that can adequately deal with the critical needs of the 1990s and beyond. To accomplish this goal requires the addition of a new laboratory wing that emphasizes centralized next-generation laser diagnostic facilities and specially designed laboratories not available in CRF Phase I. Several of these laboratories will be designed specifically to incorporate practical scale experiments that will enable stronger support of U.S. industry than is possible in Phase I.

The overall scope of this project is the doubling of space available for experiments. Equipment funds are required for a new central laser system and special purpose laboratory equipment. A modest enlargement of the office building is included to house the rapidly increasing population of visiting scientists. These enhancements will consolidate the combustion-related resources at a single site readily accessible to visiting scientists.

The present capabilities of the facility, including the unique DIANA laser, the Turbulence Diffusion Flame Laboratory, the Burner Engineering Research Laboratory, and facility computer resources have allowed significant, novel contributions to basic combustion sciences and have attracted users from industry and universities. These users are now transferring what they have learned to their home institutions and to their product lines.

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of Project (Continued)

Meanwhile, there is a continuing need for the CRF to advance combustion-related science and technology to a higher level. The improvements included in the Phase II project will address this need. For example, special lasers and equipment will be developed to provide the ability to measure quantitatively entire two- and three-dimensional images of a system's physical and chemical properties with better resolution, and far greater speed than is now possible. It is this type of advance in the science of combustion that will allow the pursuit of the increasingly more difficult and complex problems that face our country.

CRF Phase II will enable attacking many complex problems directly associated with combustion. An important example is the need for improved combustion processes that incorporate high efficiency together with minimum production of pollutants such as NO_x and air toxics. Rapid progress on these problems both in engines and in furnaces requires Phase II's next-generation diagnostic capabilities. Completion of Phase II will also enable using the tools and expertise developed in Phase I to address broader challenges facing the country. CRF basic research in laser diagnostics, for example, will underpin remote sensing applications that contribute to global-change research and to nonproliferation of weapons. Basic research in chemically reacting flows will continue to support improved U.S. competitiveness in semiconductor processing and will support the development of new industrial materials. Basic research in chemistry will address new processes, such as supercritical water oxidation, for destroying hazardous wastes with minimal environmental impact.

The implementation of Phase II will develop and make available a new class of lasers. Recent advances in laser technology demonstrate that changes in capability are now possible in two different directions. Phase II will include a specially designed high repetition rate laser system. This laser will be optimized for laser photochemistry combustion research and for high speed planar imaging of transient combustion phenomena. A second laser system will be designed to study combustion phenomena occurring on extremely short time scales (subpicosecond time scales). The new laser systems will enable significant extension of our knowledge in a broad range of topics in fundamental combustion science.

The normal increase in both the quantity and sophistication of combustion research by Sandia staff, together with the heightened requirements of visiting scientists, have completely saturated the facilities provided under CRF Phase I. During the past ten years the number of scientists who visit the CRF long enough to participate in research has almost tripled. In fiscal year 1993 forty professional staff hosted eighty nine such visits. Many important experiments cannot be carried out in the existing facilities because of a lack of space. Access to the unique capabilities of the CRF (such as the Facility lasers and computer resources) is essential for studying

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of Project (Continued)

trade-offs between combustion efficiency and the pollution that results from existing and alternative fuels. However, much of the combustion research and diagnostics development work at Sandia is currently being done in facilities that are widely scattered throughout Sandia/CA where the researchers do not have access to these unique capabilities. Additional laboratories will permit the consolidation of these experiments at the CRF, thus providing the necessary access to the unique capabilities at the Facility. It will also provide adequate space and ready access to visiting scientists.

Operating experience has shown that many experiments require laboratories larger than those currently available in the Facility. As the research emphasis evolves from studies of simple basic flames and major chemical species toward work with more complex, realistic flames and with minor species and pollutants, the experiments necessarily become increasingly complex and require larger working spaces. The addition of the sixteen larger test laboratories included in Phase II of the Combustion Research Facility will satisfy these requirements.

The number of offices required to support visiting researchers and staff must also be increased. Though additions to the resident staff have been few, each year of operation brings a large number of requests from qualified researchers to do work here. Furthermore, as experiments become more complex, researchers must often stay longer.

This addition is crucial to continuation of the lead role the CRF now plays in developing, improving, and applying advanced research methods for combustion science. As a result of successful technology transfer from the CRF to visiting scientists, there has been a significant advance in the research methods practiced by the combustion community. Given the increasingly difficult challenges faced in the use of fuel resources, the CRF mission must continue to emphasize advancing the frontiers of combustion science.

Without Phase II the technology at the CRF will stagnate, and opportunities for important new scientific research will be missed. The major advances in lasers and computers will not be brought to bear on pressing problems, nor made available to combustion researchers and designers in this country. CRF Phase II is also crucial to the success of programs in combustion research and diagnostics development. Currently, progress is hampered by the fractionation of the research effort. A significant amount of the experimental activities are housed in other buildings without direct access to the Facility lasers and other resources. Some of the activities are in security areas where it is difficult or impossible for uncleared visiting researchers to work. Moreover, the major portion of the diagnostics research is housed in a converted warehouse; it is essential that this activity be moved to an area that provides cleaner air, better temperature control, improved safety, access to the Facility lasers, and unrestricted availability to users.

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

9. Purpose, Justification of Need For, and Scope of Project (Continued)

Finally, without the Phase II addition to the Facility, the size of the visiting scientist (user) program will have to be curtailed, due to the saturation of laboratory and office space. As a result, the ability for the combustion community to move on to more complex, yet realistically important research topics, will be constrained.

10. Details of Cost Estimate

		Unit Cost	Item Cost	Total Cost
a.	Engineering, design, and inspection (ED&I)			$ 3,100
	1. Engineering, design, and inspection at approximately 15% of construction		2,050	
	2. Construction management costs		500	
	3. Project management		550	
b.	Construction costs			14,610
	1. Improvements to land		1,010	
	Paving, walkways, landscaping, fencing, signage, road relocation parking lot rearrangement			
	2. Buildings		12,800	
	(a) Office Building (11,000 SF $190/SF)	2,300		
	(b) Laboratory Building (21,200 SF $415/SF)	9,740		
	(c) Mechanical Building (Existing)	760		
	3. Utilities		800	
	Water, sanitary sewer, natural gas, site lighting, electrical power, signal systems			
c.	Standard equipment			5,450
	Lasers, spectrometers, analyzers, processing equipment			
	Subtotal			23,160
d.	Contingency at approximately 16% of above costs			3,640
	Total line item cost			$26,800

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

10. Details of Cost Estimate (Continued)

ED&I costs for Title I and II reflect negotiated contract fees. ED&I for Title III is based on a negotiated fee plus an allowance for an extended period of construction, and for escalation. Construction costs and equipment costs have been escalated to mid points of construction and equipment procurement and installation. Escalation rates are in agreement with the DOE Price Change Index dated August 1993 for DOE construction projects, published by the DOE Independent Cost Estimating Staff.

Contingency is judged to be adequate for the remainder of the project. Construction of the laboratory shell was completed in FY 1990. Design was completed for the balance of the construction work in FY 1989. As a result of zero appropriations in FY 1989 through FY 1995 and the consequential schedule extension, some remaining ED&I and Project Management funds will be expended on obsolete Title II design elements prior to going to bid for remaining construction.

11. Method of Performance

Engineering, design, and inspection will be performed under negotiated architect and engineer contracts. Construction, procurement of equipment, and occupancy will be accomplished by fixed price contracts awarded on the basis of competitive bidding.

12. Schedule of Project Funding and Other Related Funding Requirements

	Prior Yrs.	FY 95	FY 96	FY 97	FY 98	FY 99	Total
a. Total project funding							
1. Total facility costs							
(a) Line item (Sec. 10).....	$4,205	$ 450	$1,700	$ 9,400	$ 6,800	$4,245	$26,800
Total direct cost.....	4,205	450	1,700	9,400	6,800	$4,245	26,800
2. Other project costs							
(a) Other project costs.....	220	0	0	500	750	750	2,220
(b) Capital equipment.....	0	0	0	500	250	250	1,000
Total other project costs.....	220	0	0	1,000	1,000	1,000	3,220
Total project cost (TPC).....	4,425	450	1,700	10,400	7,800	5,245	30,020

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

12. Schedule of Project Funding and Other Related Funding Requirements (Continued)

b. Related annual funding [a/] (estimated life of building: 50 years)

1. Facility operating costs	$ 300
2. Programmatic operating expenses directly related the facility	2,400
3. Capital equipment not related to construction but related to the programmatic effort in the facility	400
4. GPP or other construction related to programmatic effort in the facility	200
5. Other costs	0
Total related annual funding	$ 3,300

a/ Estimated costs in thousands escalated to 1999-year dollars. The related annual funding displayed is related to CRF, Phase II project only. These amounts are in addition to annual funding for the existing CRF operations ($4,487,000 in the FY 1996 OMB Budget Request).

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding

1. Total facility costs

(a) Construction Line Item as described in previous items.

2. Other project costs

(a) Other project costs

$220,000 of operating funds have been paid to architect engineering firms for preparation of conceptual designs/conceptual design reports and supplemental information for this project. $500,000 in FY 1997, $750,000 in FY 1998, and $750,000 in FY 1999, are operating costs associated with the new facility.

(b) $500,000 in FY 1997, $250,000 in FY 1998, and $250,000 in FY 1999 is for capital equipment associated with the new facility.

1. Title and Location of Project:	Combustion Research Facility, Phase II Sandia National Laboratories Livermore, California	2a. Project No. 87-R-405 2b. Construction Funded

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements (Continued)

b. Related annual funding

1. Facility operating costs
   This cost represents the annual operating expenses for utilities, maintenance, and janitorial service incurred due to the increase of 32,300 gross square feet in laboratory and office space.
2. Programmatic operating expenses
   Staff increase resulting from this project is estimated to be six people. Costs also include acquisition of computer resources that will serve both resident staff and visiting scientists.
3. Capital equipment not related to construction
   The increase in annual capital equipment is estimated at $400,000. This is in addition to Capital Equipment funds currently allocated to the CRF.
4. Maintenance, repair, GPP or other construction related to programmatic effort
   The annual GPP needs for Phase II are expected to be approximately $200,000. This is in addition to GPP funds presently allocated to the CRF.
5. Other costs
   No other costs are anticipated.

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT

OVERVIEW

ADVANCED NEUTRON SOURCE (ANS)

The Advanced Neutron Source was planned to be an experimental facility designed to meet the Nation's need for an intense steady-state source of neutrons. The facility was to be based on a new research reactor that would have had the most intense neutron beams in the world, exceeding its closest competitor by a factor of 5 to 10. The Advanced Neutron Source would have replaced both the High Flux Beam Reactor and the High Flux Isotope Reactor, and would have provided increased research capability and increased assurance of worker and public safety.

The Advanced Neutron Source was designed to meet the programmatic needs of the Department of Energy in condensed matter physics, chemistry, biological sciences, materials science, polymer science, isotope production, and materials irradiation. In addition, it would have functioned as a national facility open to researchers from universities, national laboratories, and industry. Based on the experience in Europe, the Advanced Neutron Source would have served over 1,000 researchers per year.

Because of the high cost of ANS and increasing budget constraints, no FY 1996 funds are provided for ANS. The Department plans to propose to reprogram funds remaining in FY 1995 for conceptual design of a spallation neutron source in the Basic Energy Sciences program.

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative in whole dollars).

LEAD TABLE

Advanced Neutron Source

Activity	FY 1994 Adjusted	FY 1995 Appropriation	FY 1995 Adjustment	FY 1995 Adjusted	FY 1996 Request
Operating Expenses	$16,243	$20,000	-$236	$19,764	$0
Capital Equipment	0	1,000	0	1,000	0
Subtotal, Program	$16,243	$21,000	-$236	$20,764	$0
Adjustment	-307 a/	-127 a/	0	-127 a/	0
Total, Program	$15,936 b/	$20,873	-$236	$20,637	$0
Summary					
Operating Expenses	15,936	19,873	-236	19,637	0
Capital Equipment	0	1,000	0	1,000	0
Total, Program	$15,936	$20,873	-$236	$20,637	$0

Staffing (FTE's) ..... (Included in Basic Energy Sciences Program Direction)

Authorization: Section 209, P.L. 95-91, "Department of Energy Organization Act"

a/ Share of Energy Supply, Research and Development general reduction for use of prior year balances assigned to this program. The total general reduction is applied at the appropriation level.

b/ Excludes $243,000 which has been transferred to the SBIR program and $8,100 which has been transferred to the STTR program.

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands, narrative in whole dollars)

SUMMARY OF CHANGES

Advanced Neutron Source

FY 1995 Appropriation	$ 21,000
- Adjustment	- 236
FY 1995 Adjusted	$ 20,764
Operating Expenses	- 19,764

No activity.

Capital Equipment	- 1,000

No activity.

FY 1996 Congressional Budget Request	$ 0

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

ADVANCED NEUTRON SOURCE RESEARCH, DEVELOPMENT AND OPERATIONS

I. Preface: Advanced Neutron Source Research, Development and Operations

Because of the high cost of ANS and increasing budget constraints, no FY 1996 funds are provided for ANS.

II. A. Summary Table: Advanced Neutron Source Research, Development and Operations

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Advanced Neutron Source Research, Development and Operations	$ 16,243	$ 19,764	$ 0	$ -19,764
Total, Advanced Neutron Source Research, Development and Operations	$ 16,243	$ 19,764	$ 0	$ -19,764

II. B. Laboratory and Facility Funding Table: Advanced Neutron Source Research, Development and Operations

Oak Ridge National Lab	$ 15,536	$ 19,000	$ 0	$ -19,000
Argonne National Lab (East)	200	0	0	0
Brookhaven National Lab	175	0	0	0
All Other	332	764	0	-764
Total, Advanced Neutron Source Research, Development and Operations	$ 16,243	$ 19,764	$ 0	$ -19,764

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

Program Activity	FY 1994	FY 1995	FY 1996
Advanced Neutron Source Research, Development and Operations	The FY 1994 research and development (R&D) program was a continuation of designs, tests, and modelling of ANS components to provide further results prior to ANS construction. Activities in FY 1994 included fuel element R&D such as the irradiation of the second miniplate in the reflector region of the High Flux Isotope Reactor facility. Upper and lower fuel elements without uranium in fuel plates were fabricated for use in core flow tests. Dynamic tests of some reactor core elements, the control rods, and the reflector shutdown rods were carried out. A study was undertaken to examine the impact on the ANS performance goals if low or medium-enriched fuel is used rather than the highly enriched fuel used for the design. The study will build on existing information using currently developed fuels and focus on low (20%) and medium (35%) enriched fuel. Continued work on the Environmental Impact Statement.	Because of the high cost of ANS and increasing budget constraints, no FY 1996 funds are provided for ANS. The Department plans to propose to reprogram funds remaining in FY 1995 for conceptual design of a spallation neutron source in the Basic Energy Sciences program.	The Administration proposes not to continue the Advanced Neutron Source (ANS) reactor project in FY 1996. Although the Department of Energy will complete certain research and development and engineering design activities described in the FY 1995 Energy and Water Development Appropriations Act conference report, no additional financial commitments will be made on behalf of the project after the submission of the FY 1996 budget request to Congress. Concern about the high cost of building the ANS reactor was the primary factor in the Administration's decision to propose terminating the project. There was also a non-proliferation policy concern about the 93-percent enriched fuel that the ANS reactor was designed to use. The development of a technically acceptable lower enriched fuel would have required further research and development. The Administration will propose to reprogram remaining funds from the FY 1995 appropriation for the ANS project to support research and development and engineering design activities leading to the conceptual design of a spallation neutron source to meet the Nation's need for a next-generation neutron scattering source. An additional $8 million for this purpose is also requested in FY 1996 in the Basic Energy Sciences program. The preferred alternative site for a spallation neutron source would be Oak Ridge National Laboratory, in order to maximize the use of neutron source design expertise already developed through the preparation of the ANS conceptual design, and to take advantage of the laboratory's

III. Advanced Neutron Source Research, Development and Operations (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Advanced Neutron Source Research, Development and Operations (Cont'd)			experience in operating particle accelerators and conducting neutron scattering research. The spallation source research and development effort will make use of the best capabilities in the DOE laboratories, including the Defense Programs' Accelerator Production of Tritium (APT) project at Los Alamos National Laboratory. Without a major new neutron source or upgraded operation of an existing research reactor, the United States will forego significant scientific, technical, and economic benefits that derive from neutron scattering and materials irradiation research and the production of medical isotopes. A spallation neutron source should enable the Nation to carry out major research activities in areas such as biology, materials science, superconductivity, pharmaceuticals, electronic materials, and many other technological areas that are critical for future U.S. economic competitiveness and national security.
	EPACT: EPACT Section 2203(a)(2)(d) "Supporting Research and Technical Analysis": Provided funds to further develop the design and provide the technical foundation for the Advanced Neutron Source. Funding in the amount of $243,000 and $8,100 has been transferred to the SBIR program and the STTR program, respectively.	Funding in the amount of $392,750 and $19,637 has been budgeted for the SBIR program and the STTR program, respectively.	

III. Advanced Neutron Source Research, Development and Operations (Cont'd):

Program Activity	FY 1994	FY 1995	FY 1996
Advanced Neutron Source Research, Development and Operations (Cont'd)	$ 16,243	$ 19,764	$ 0
Advanced Neutron Source Research, Development and Operations	$ 16,243	$ 19,764	$ 0

DEPARTMENT OF ENERGY
FY 1996 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

CAPITAL EQUIPMENT

I. Preface: Capital Equipment

Because of the high cost of ANS and increasing budget constraints, no FY 1996 funds are provided for ANS.

II. A. Summary Table: Capital Equipment

Program Activity	FY 1994 Adjusted	FY 1995 Adjusted	FY 1996 Request	$ Change
Capital Equipment	$ 0	$ 1,000	$ 0	$ -1,000
Total, Capital Equipment	$ 0	$ 1,000	$ 0	$ -1,000

II. B. Laboratory and Facility Funding Table: Capital Equipment

Oak Ridge National Lab	$ 0	$ 1,000	$ 0	$ -1,000
Total, Capital Equipment	$ 0	$ 1,000	$ 0	$ -1,000

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

Program Activity	FY 1994	FY 1995	FY 1996
Capital Equipment	No activity.	Because of the high cost of ANS and increasing budget constraints, no FY 1996 funds are provided for ANS. The Department plans to propose to reprogram funds remaining in FY 1995 for conceptual design of a spallation neutron source in the Basic Energy Sciences program.	No activity.
	$ 0	$ 1,000	$ 0
Capital Equipment	$ 0	$ 1,000	$ 0