

Draft
Strategic
Laboratory
Missions
Plan

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Volume II
Mission Activity Profiles

Laboratory Operations Board
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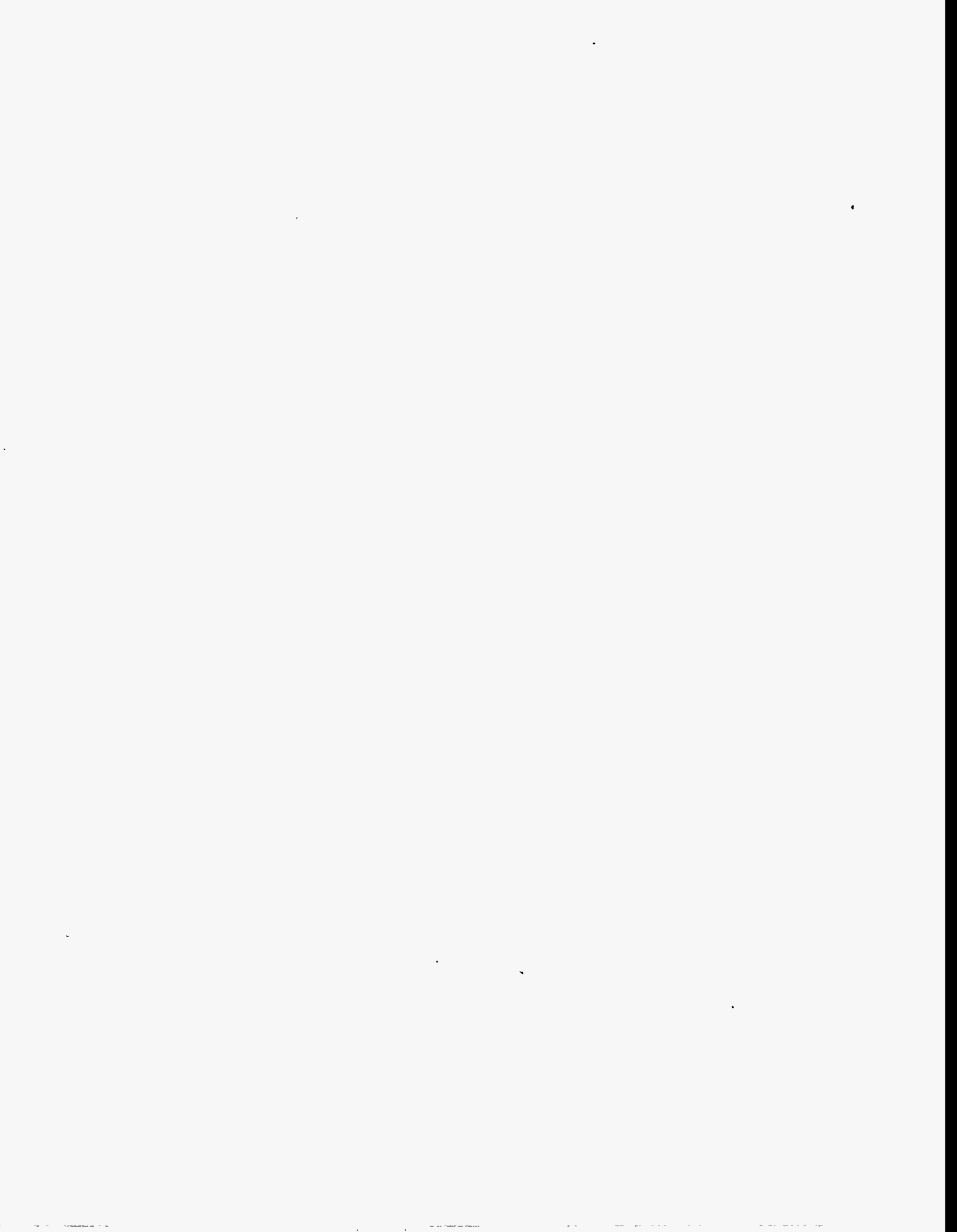
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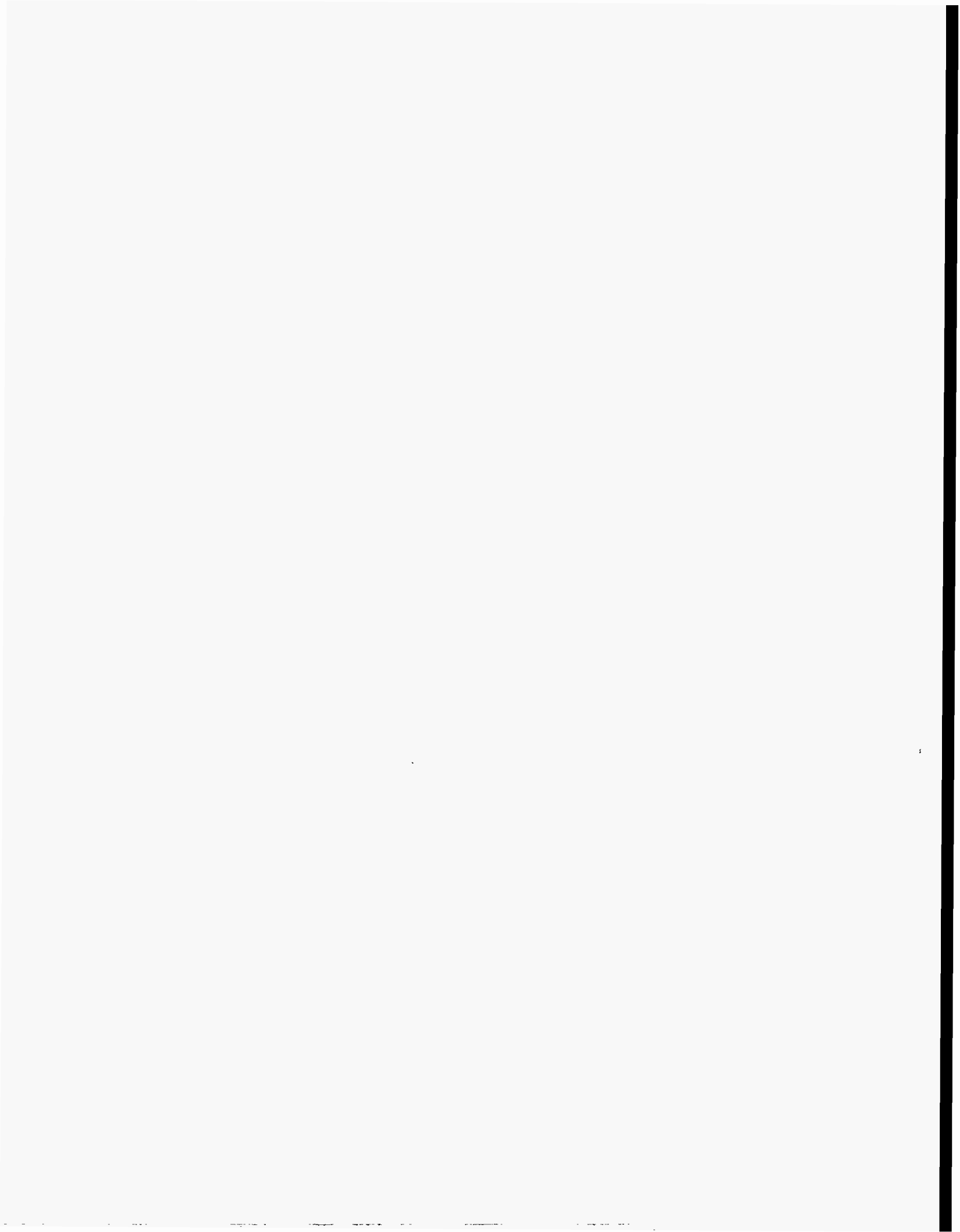
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LIST OF ACRONYMS

ALWR	advanced light-water reactor
ANL	Argonne National Laboratory
BAPL	Bettis Atomic Power Laboratory
BNL	Brookhaven National Laboratory
CEBAF	Continuous Electron Beam Accelerator Facility
DOD	Department of Defense
DOE	Department of Energy
EML	Environmental Measurements Laboratory
EPRI	Electric Power Research Institute
ETEC	Energy Technology Engineering Center
FNAL	Fermi National Accelerator Laboratory
FOAKE	first-of-a kind engineering
HEU	highly enriched uranium
INEL	Idaho National Engineering Laboratory
ITRI	Inhalation Toxicology Research Institute
KAPL	Knolls Atomic Power Laboratory
LANL	Los Alamos National Laboratory
LBNL	Ernest Orlando Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratory
LREH	Laboratory of Radiobiology and Environmental Health
METC	Morgantown Energy Technology Center

NAS	National Academy of Sciences
NBL	New Brunswick Laboratory
NIPER	National Institute for Petroleum and Energy Research
NREL	National Renewable Energy Laboratory
NRL	Naval Research Laboratory
NSF	National Science Foundation
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
PEIS	programmatic environmental impact statement
PETC	Pittsburgh Energy Technology Center
PNNL	Pacific Northwest National Laboratory
PPPL	Princeton Plasma Physics Laboratory
SLAC	Stanford Linear Accelerator Center
SNL	Sandia National Laboratories
SREL	Savannah River Ecology Laboratory
SRTC	Savannah River Technology Center
UR/LLE	University of Rochester Laboratory for Laser Energetics

DRAFT STRATEGIC LABORATORY MISSION PLAN MISSION ACTIVITY PROFILES

Preface

This volume describes in detail the Department's research and technology development activities and their funding at the Department's laboratories. It includes 166 Mission Activity Profiles, organized by major mission area, with each representing a discrete budget function called a Budget and Reporting (B&R) Code. The activities profiled here encompass the total research and technology development funding of the laboratories from the Department. Each profile includes a description of the activity and shows how the funding for that activity is distributed among the DOE laboratories as well as universities and industry. The profiles also indicate the principal laboratories for each activity, as well as which other laboratories are involved.

The information in this volume is at the core of the Strategic Laboratory Mission Plan. It enables a reader to follow funds from the Department's appropriation to a specific activity description and to specific R&D performing institutions. This information will enable the Department, along with the Laboratory Operations Board and Congress, to review the distribution of R&D performers chosen to execute the Department's missions.

We expect this process to result in a clearer understanding both of how the Department manages its research and technology development programs and the rationale for this management. We also expect that these reviews will result in management improvements, such as:

- Management of the laboratories more as a system, primarily by establishing the laboratories that serve as the principal institutions in each area.
- More productive and streamlined management of R&D programs by DOE headquarters and the laboratories.

The information will also help the Department and Congress work together to address the complex issue of eliminating redundancies within the National Laboratory system without the jeopardizing the complementary skills and diversity of approaches needed to accomplish the Department's missions.

We caution against using this as a tool for micromanagement of the laboratories. If the detailed information in this plan fuels prescriptive, narrowly focused policy or management actions that subvert the process of ensuring that R&D is performed in the most cost-effective way possible in pursuit of national needs, then it will have been misused.

Technical Notes on the Mission Activity Profiles

Activities Included

The budget codes profiled here include all of the research and technology development activities of the laboratories that are funded by the Department. They includes some technical activities performed by the laboratories that are not classified as R&D according the Office of Management and Budget definitions. An example of this kind of activity is the engineering support work for the Waste Isolation Pilot Plant and the Yucca Mountain Site Characterization Project.

The profiles include only those activities funded and directed by the Department of Energy. It does not include work funded by other agencies or private organizations at the laboratories. For some laboratories, this constitutes 20 percent of the laboratories' activities. In addition, the profiles do not include descriptions of work that is funded out of the laboratory overhead. This includes laboratory-directed research and development, which is typically 1 to 6 percent of each laboratory's budget and is allowed by statute to be directed by the laboratory. It also does not include support activities at the laboratories, such as security, environment, safety and health management, or site cleanup.

Designation of Principal, Contributing, and Participating Laboratories

The Laboratory Complex box identifies which laboratories are the principal, contributing, and participating laboratories for each mission activities. These have been designated according to the percentage of the mission activity's funding. Principal laboratories are defined as those receiving more than 20 percent of the activity's funding to the laboratory complex. Contributing laboratories are those that receive between 10 and 20 percent of the funding. Participating laboratories receive between 0 and 10 percent of the funding. It should be noted that these designations are preliminary and subject to change in future drafts. At present the designations are descriptive rather than prescriptive, and are currently based on a quantitative rather than qualitative measure of each laboratory's role.

Funding History

FY 94 and FY 1995 are actual budget levels. The FY 1996 level is the appropriated level where available. For the parts of the Department without a final FY 1996 appropriation (for example, those parts funded by the Interior Appropriations bill), the FY 1996 budget request is used.

Laboratory-Academia-Industry Participation

The distribution of funds between laboratories, academia, and industry is as provide by each program, generally based on operating funds.

Fiscal Year 1995 Funding Profile

These are based on operating funds to the 22 laboratories covered in Section VIII of Volume 1.

Stockpile Readiness

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Development and Testing
B&R Code: GB0103141

Laboratory Complex

Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

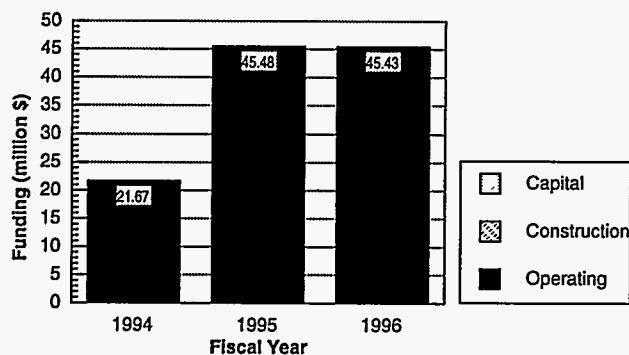
The U.S. nuclear deterrent forms a cornerstone of national security policy. DOE is responsible for keeping the U.S. nuclear weapons stockpile safe and reliable. The Stockpile Readiness activity supports the stewardship of the nuclear weapons stockpile and includes the development for and support of the day-to-day activities needed to support the evaluation and maintenance of nuclear weapons in the active and inactive stockpile. It also directly supports Science-Based Stockpile Stewardship by increasing our understanding of stockpile aging and reliability. Stockpile Readiness includes development activities supporting weapons such as stockpile maintenance, stockpile evaluation, and stockpile technical support and excludes direct weapon development.

Stockpile Maintenance—Those activities directly associated with maintaining the weapons in the stockpile and associated ancillary gear. This task provides design support for Stockpile Management activities not directly tied to a specific weapon.

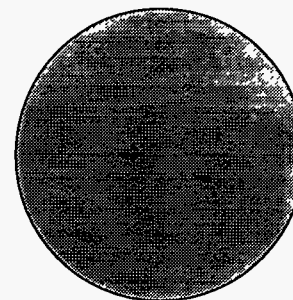
Stockpile Evaluation—Those activities associated with understanding the quality, reliability, surety, and revalidation of weapons and components in the existing stockpile. Stockpile evaluation also includes surveillance activities on existing stockpile weapons and components to assure the reliability and safety of fielded weapons. Laboratory tests focus on detecting defects due to aging, manufacture, and/or design. Flight tests are concerned primarily with the integration and functionality of electrical and mechanical subsystems.

Stockpile Technical Support—Those activities necessary for military liaison, emergency response, and associated technical requirements for weapons. Activities, such as military liaison and supporting Project Officer Meetings are included.

Funding History

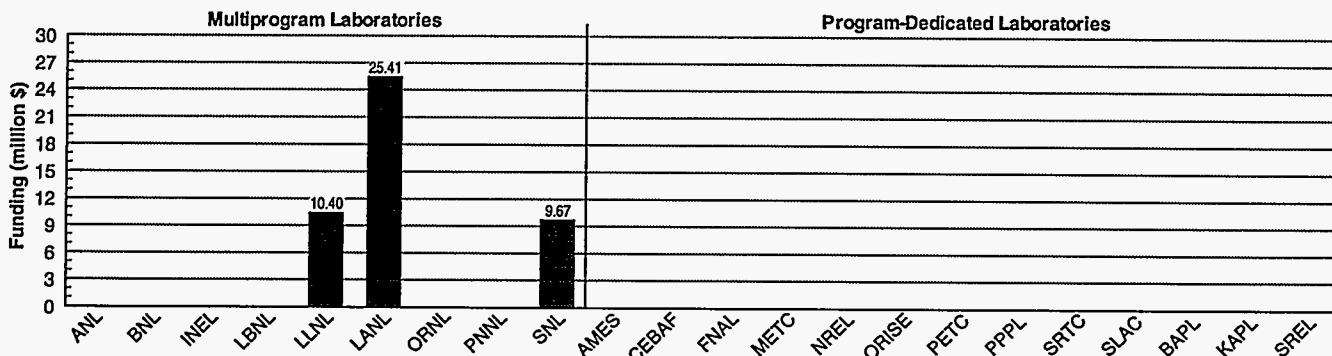


Laboratory-Academia-Industry Participation



FY 1995 Data

Fiscal Year 1995 Funding Profile



Enduring Stockpile

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Development and Testing
B&R Code: GB0103145, GB0103143

Laboratory Complex

Principal Laboratories: SNL
Contributing Laboratories: LANL, LLNL
Participating Laboratories: None

Mission Activity Description

The U.S. nuclear deterrent forms a cornerstone of national security policy. DOE is responsible for keeping the U.S. nuclear weapons stockpile safe and reliable. This includes not just maintenance, but also improvements to the nuclear weapons necessary to ensure their safety, security, and reliability in the enduring stockpile (those weapons that will remain in the stockpile for a prolonged period of time). The Enduring Stockpile activity is part of the DOE's effort to ensure the safety and reliability of U.S. nuclear weapons. To achieve its purpose, the Enduring Stockpile activity includes all activities for demonstrating or implementing stockpile improvements on weapons in the enduring stockpile. It includes those activities on stockpile weapons that are intended to:

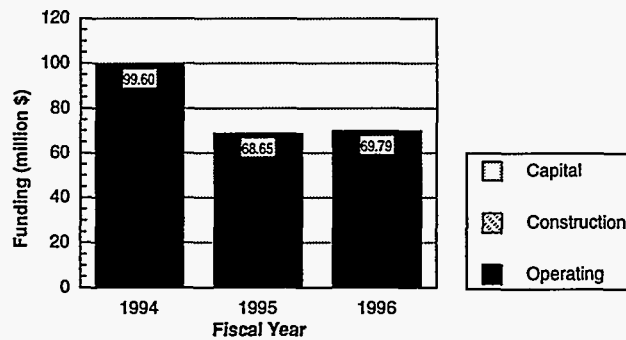
- Extend weapon life
- Improve surety (that is, safety, reliability, and use control)
- Improve operational reliability and utility

The two major subprograms in the Enduring Stockpile activity are the stockpile improvements program and the stockpile option program.

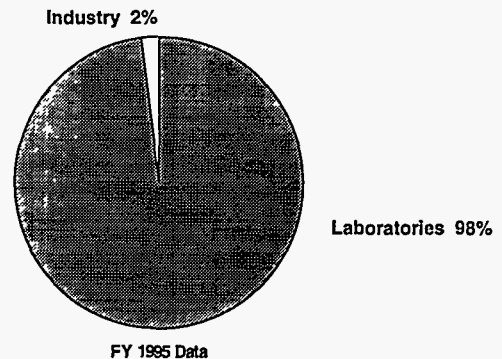
Stockpile Improvement Programs—Those activities for concept definition, feasibility studies, development engineering, and production engineering of weapon alterations, modifications, or replacements formally approved or requested by the Department of Defense.

Stockpile Option Programs—In the absence of appropriate sanctioned stockpile improvement activities, those activities that maintain and demonstrate the Department of Energy's capabilities associated with stockpile improvements and for replacing or remanufacturing stockpile weapons by researching possible options.

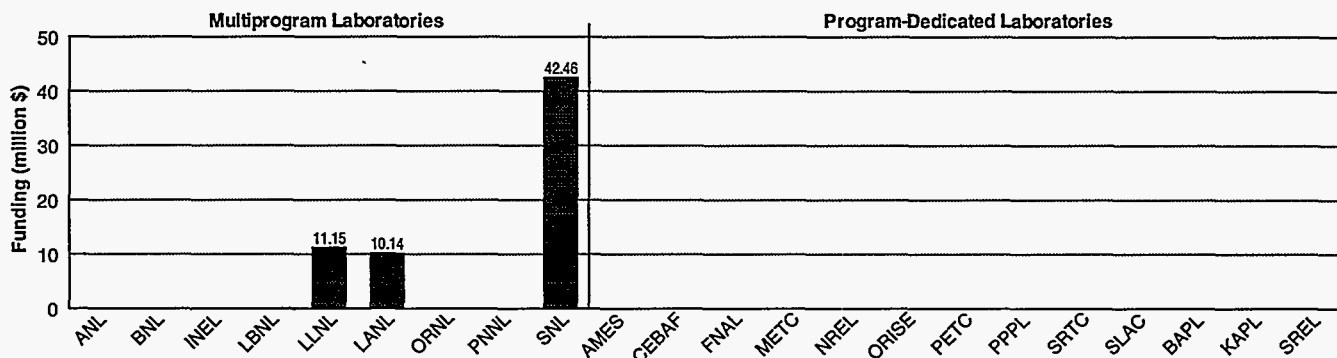
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Future Stockpile

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Development and Testing
B&R Code: GB0103144, GB0103146

Laboratory Complex

Principal Laboratories: SNL
Contributing Laboratories: LANL
Participating Laboratories: LLNL

Mission Activity Description

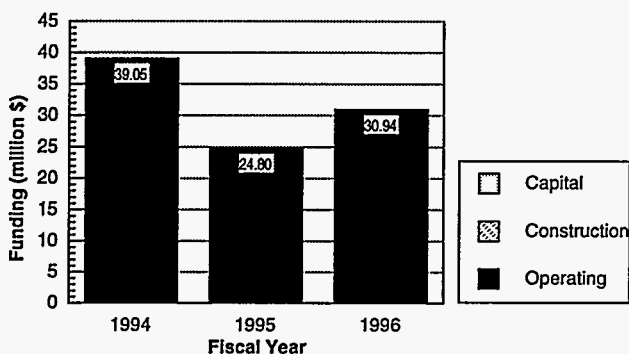
The U.S. nuclear deterrent forms a cornerstone of national security policy. DOE is responsible for keeping the U.S. nuclear weapons stockpile safe and reliable. This includes, besides maintenance and stockpile improvements, new capabilities needed for future weapon options. The Future Stockpile activity is part of the DOE's effort to ensure the safety and reliability of the nuclear weapon deterrent for the future. The purpose of the Future Stockpile activity is to provide non-weapon-specific developmental activities for anticipating nuclear weapon needs and examining future nuclear weapon options. The activities in the Future Stockpile activity include development for joint Department of Defense (DOD) and DOE studies, enhanced surety (safety, security, and use control), and future technologies.

Joint DOD and DOE Phase Studies—Those activities with DOD to develop weapons concept definition, feasibility, or assessments of new weapons capabilities.

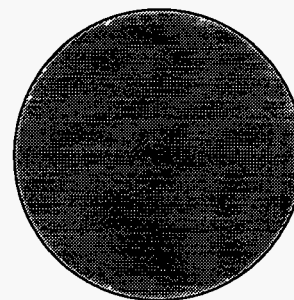
Enhanced Surety—Those development activities involving use control, security, and safety concepts or feasibility. Principally non-weapon-specific nuclear and nonnuclear technologies aimed at meeting anticipated future surety requirements to be applied as upgrades or retrofits to existing weapons.

Future Technology—Those development activities examining non-weapon-specific (that is, general concepts or technologies that may be employed in new or modified designs, such as ceramic-coated fire resistant pits) nuclear and nonnuclear technologies addressing anticipated future stockpile weapons needs to maintain their performance and reliability.

Funding History



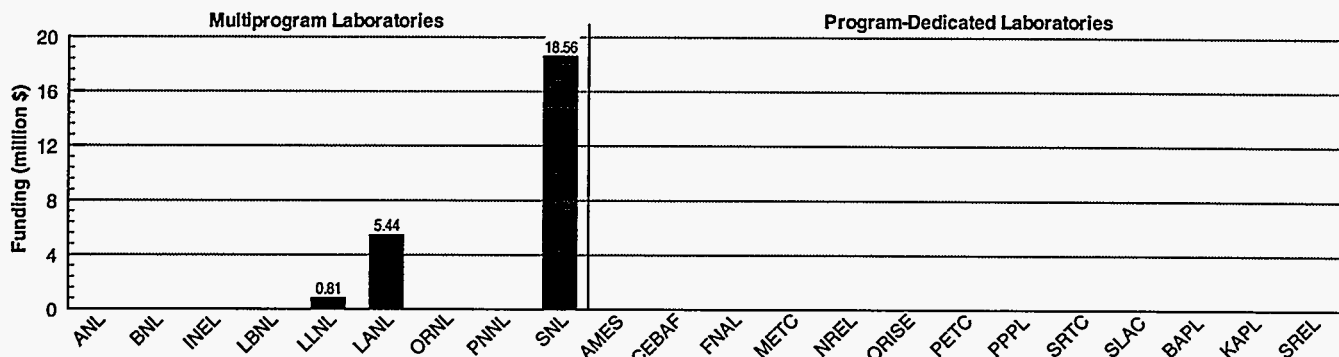
Laboratory-Academia-Industry Participation



Laboratories 100%

FY 1995 Data

Fiscal Year 1995 Funding Profile



Stockpile Reduction

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Development and Testing
B&R Code: GB0103142

Laboratory Complex

Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

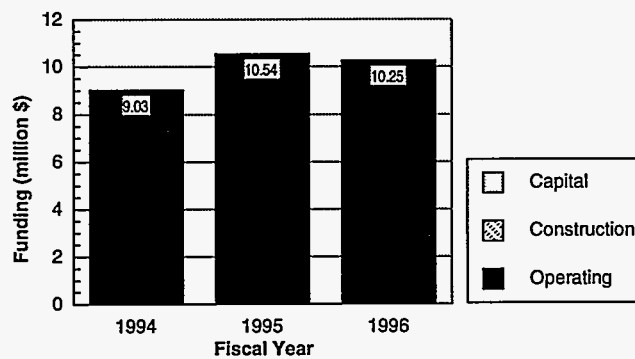
The U.S. nuclear deterrent forms a cornerstone of national security policy. DOE is responsible for keeping the U.S. nuclear weapons stockpile safe and reliable. This includes both the dismantlement and disposal of nuclear weapons and their components. The Stockpile Reduction activity is part of the DOE's effort to provide support for the safe and secure dismantlement of retired nuclear weapons. The increase in dismantlement brings an increased awareness of current environmental safety and health requirements compliance. The three nuclear laboratories provide the unique technical expertise, diversity of research capabilities, and many years of experience necessary to provide safe and reliable methods for dismantling and storing nuclear weapons. Storage or disposal of components at Pantex, Y12, or other sites will require modern criteria to be considered and design agency presence, and involvement in, the dismantlement of weapons and components. The Stockpile Reduction activity supports the development activities for dismantling weapons and disposing of components and materials. These activities include development for weapon dismantlement, disposal, and storage.

Weapon Dismantlement—Those activities to ensure the safe and secure dismantlement of weapons being removed from the existing stockpile. This includes activities such as studies on dismantlement techniques.

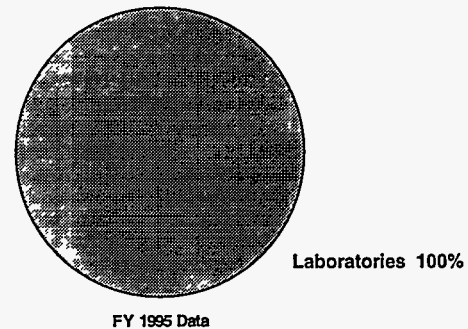
Disposal—Those activities to ensure environmentally safe disposal of dismantled weapon parts and components. This includes activities such as R&D on remediation of former storage and disposal areas.

Storage—Those activities necessary for safe and secure storage of critical nuclear materials and components. This includes investigation of newer, more effective, and less expensive monitoring techniques.

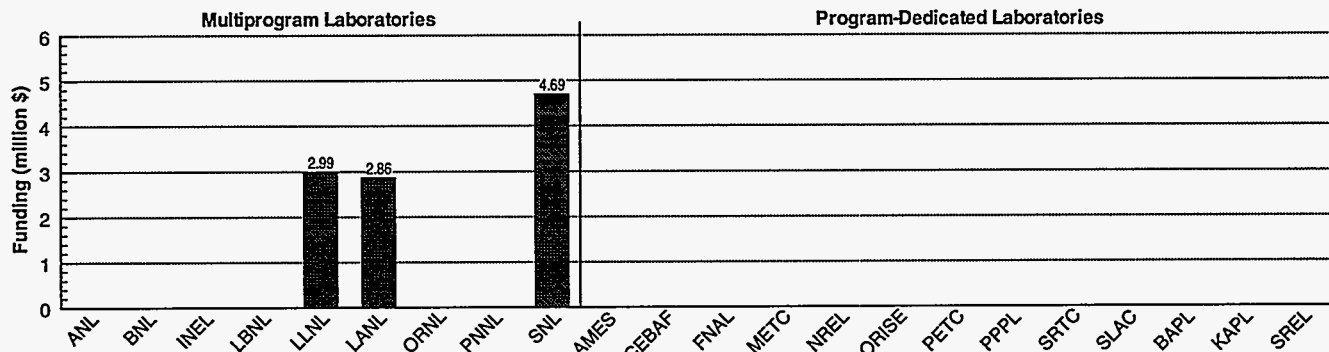
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Experimental Activities

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Development and Testing
B&R Code: GB0108

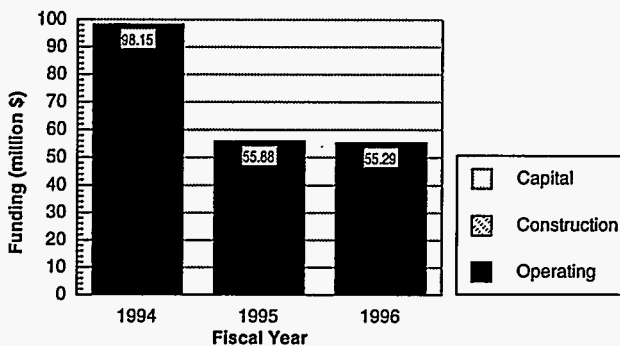
Laboratory Complex

Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: None

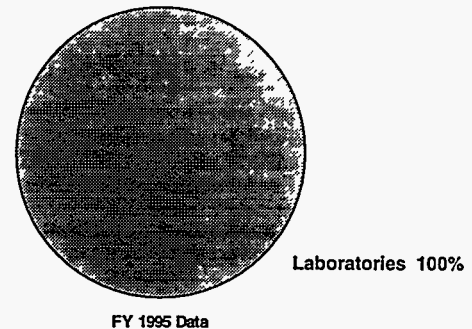
Mission Activity Description

The U.S. nuclear deterrent forms a cornerstone of national security policy. DOE is responsible for keeping the U.S. nuclear weapons stockpile safe and reliable. When the President announced the zero-yield Comprehensive Test Ban Treaty on August 11, 1995, he indicated U.S. participation was conditioned on several safeguards. One of the safeguards requires a Science-Based Stockpile Stewardship program "including the conduct of a broad range of effective and continuing experimental programs." Experimental activities will provide data to baseline the current stockpile, and also provide input for the Nation's ongoing Science-Based Stockpile Stewardship program to gain an understanding of stockpile aging and effects on reliability. Subcritical experiments at the Nevada Test Site coupled with hydrodynamic experiments at the National Laboratories are planned and approved means designed to compensate for the loss of underground nuclear testing. DOE is also responsible for Nevada Test Site readiness—that is, if a nuclear test were required to resolve an unforeseen problem that might arise to seriously jeopardize the safety and/or reliability of a stockpile system. A program of underground subcritical experiments at the Nevada Test Site will provide tangible assurance that this Presidential requirement is being met. Moreover, by providing data in an ongoing experimental program within Science-Based Stockpile Stewardship, it will be much less likely that the Nation will be confronted with a stockpile emergency that requires a nuclear test for resolution.

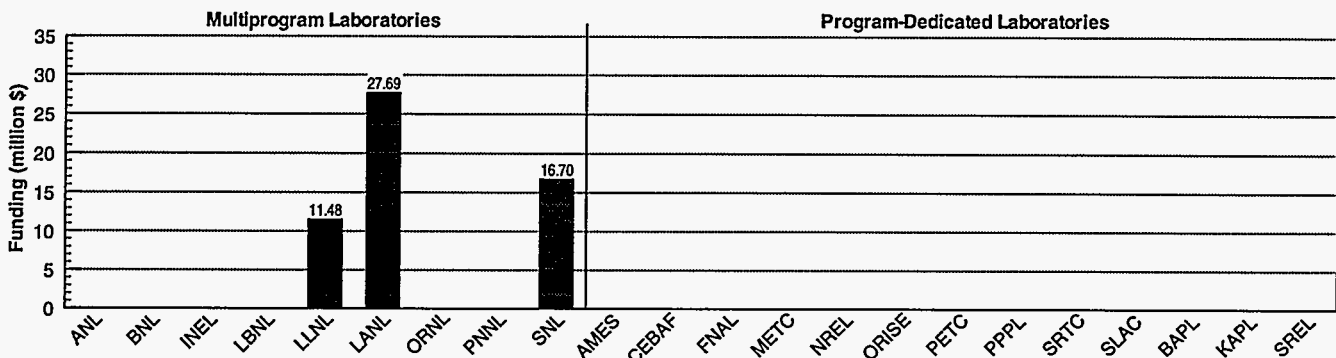
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Weapons Transportation Safeguards

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103045

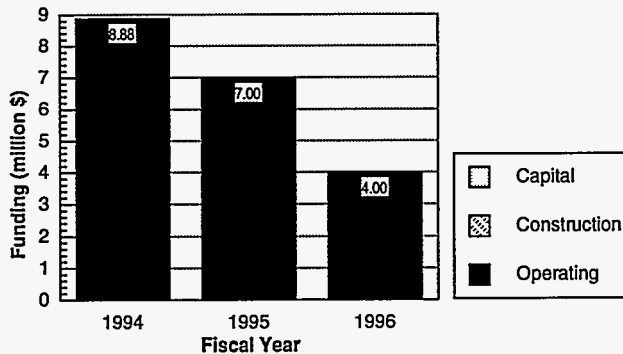
Laboratory Complex

Principal Laboratories: SNL
Contributing Laboratories: None
Participating Laboratories: None

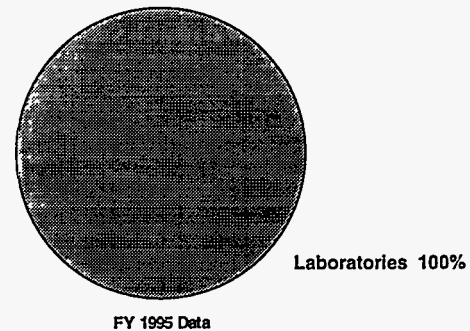
Mission Activity Description

Maintaining a safe and secure nuclear stockpile is one of the primary responsibilities of the Department of Energy. Nuclear weapons often must be moved from one location to another. The Safe Secure Transport (SST) system utilizes specially constructed, monitored, escorted, and heavily protected tractor trailer trucks to move nuclear weapons and special nuclear material over the United States highway system. This has been the only authorized method of transportation available since the use of trains was eliminated. The laboratories (particularly SNL) have been involved in all aspects of the physical protection, mechanical, packaging, and transportation requirements of the DOE nuclear weapons complex since the inception of the transportation program, and the Albuquerque Operations Office coordinates the training and administration of the DOE courier and transportation program in conjunction with SNL. The SST system is 20 years old, and DOE is developing a prototype replacement system called the SafeGuards Transporter to continue to provide a superior, state-of-the-art, and extraordinarily safe means of transporting nuclear weapons and associated sensitive materials. A sample of weapons transportation research activities includes: (1) Enhanced geographic-based vehicle tracking system, evaluated extendability and improved query response time using the spacial index, and demonstrated a real-time graphic user interface; (2) Finalized prototype fabrication, design review, and production/operational readiness review for the SafeGuards Transporter (SGT), and delivered first production SGT; (3) Continued transportation risk assessment, to include statistical descriptions of heavy truck accident severities and analysis of the plutonium dispersal for accidents involving SGT designs.

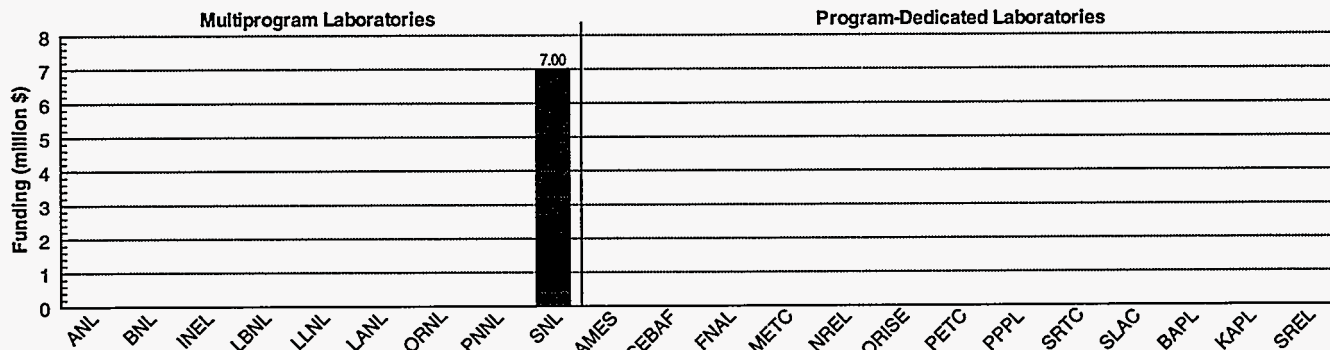
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Joint DOD/DOE Munitions Technology Development

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103049

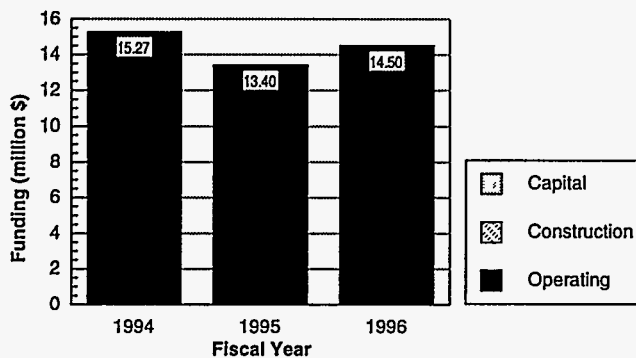
Laboratory Complex

Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: None

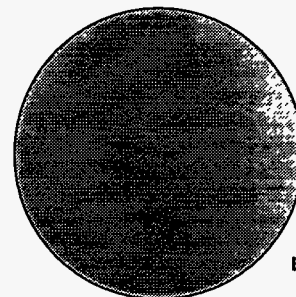
Mission Activity Description

Even though the Department of Energy has primary responsibility for the nuclear weapons stockpile, it has gained considerable expertise in conventional munitions as a result of its nuclear weapons work. A joint agreement was reached in 1985 between the Department of Defense (DOD) and DOE to utilize the expertise and infrastructure at the Defense Programs laboratories to improve conventional munitions. The agreement is entitled the "Non-Nuclear Munitions Technology Memorandum of Understanding," and the Joint DOD/DOE Munitions Technology Development Program falls under its auspices. A Technical Advisory Committee, made up of representatives from each participating laboratory, DOE, and DOD receives input from 13 Technical Coordinating Groups that oversee research in specific areas. Progress is evaluated throughout the fiscal year, and decisions are recommended to proceed, modify, or halt ongoing research. This program represents a highly successful leveraging, matching department funds and resources in a cooperative program of research and development in areas of mutual interest, which includes energetic materials, electronics, warhead technology, and a variety of supporting technologies. A representative sample of the activities conducted in support of this memorandum of understanding includes the following: (1) Measured mechanical properties for a range of explosives to support development of models of damaged explosive behavior; (2) Made dramatic improvements in the synthesis of explosive formulations TNAZ/ DNAZ; (3) Investigated the effects of percentage of load-bearing axial plies on the compressive strength of panels and cylinders in the application of advanced fiber composites to new munitions systems; and (4) Developed new cryptographic protocols for secure remote access to sensitive computing and information resources.

Funding History

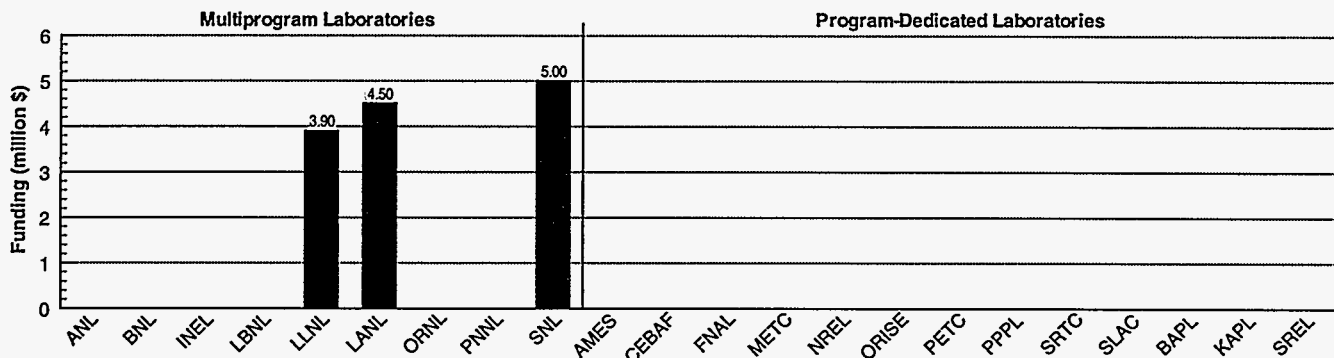


Laboratory-Academia-Industry Participation



FY 1995 Data

Fiscal Year 1995 Funding Profile



Accelerated Strategic Computing Initiative

Department of Energy Program

Program: Defense Programs
Office: Strategic Computing and Simulation
Element: Accelerated Strategic Computing Initiative
B&R Code: New activity in FY96

Laboratory Complex

Principal Laboratories: None
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

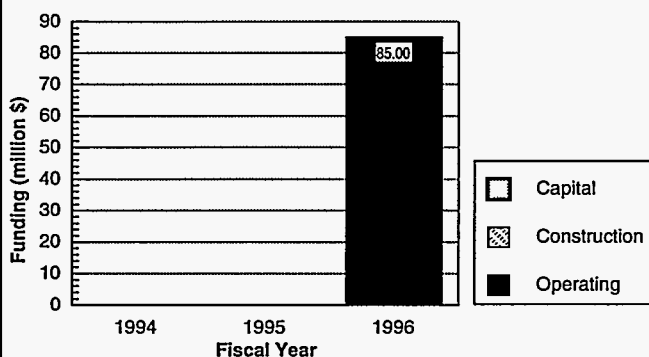
The Accelerated Strategic Computing Initiative (ASCI) is designed to accelerate the development of High Performance Computing (HPC) far beyond what might be achieved in the absence of a focused initiative. The program's goal is to provide the ability to analyze, evaluate, maintain, and prototype nuclear weapons and weapons components in the absence of underground nuclear testing. ASCI is an integrating element of the Stockpile Stewardship Program and complements the Core Computation Program by advancing Department of Energy Defense Programs computational capabilities to meet the future needs of stockpile stewardship. ASCI employs the expertise of scientists and engineers in weapons related disciplines and high-performance computing, and applies that expertise to shift from nuclear test-based methods to computational-based methods of weapon assessment. Some of the strategic thrusts of ASCI are described below.

Advanced Applications Development—ASCI seeks to provide simulations that embody 3-D capability, finer spatial resolution, and more refined physics necessary to predict the safety, reliability, performance, and manufacturability of weapons systems while eliminating empirical factors. A significant fraction of the increased computational capability envisioned by ASCI must come from improvements in the applications codes.

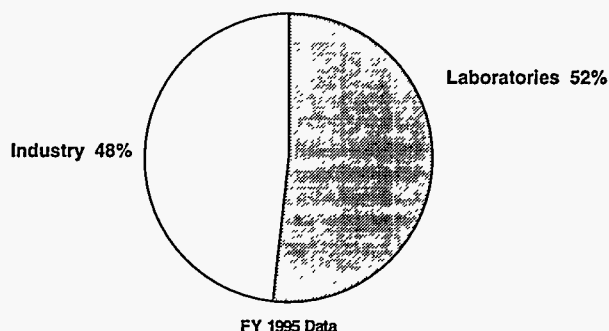
Focus on the High End of Computing—More powerful supercomputers are needed for virtual testing and prototyping applications. ASCI is stimulating the U.S. supercomputing industry to develop high-performance supercomputers with speeds and memory capacities thousands of times greater than currently available models and tens to hundreds of times greater than the supercomputers that are anticipated based on current trends in development.

Problem-Solving Environments—To couple the applications to the supercomputers and make them usable at desktops throughout the Defense Programs laboratory complex, ASCI will develop key elements needed for a computational infrastructure of high performance local area networks, wide-area networks, high-speed, high-capacity intelligent storage facilities, and software development and data visualization tools.

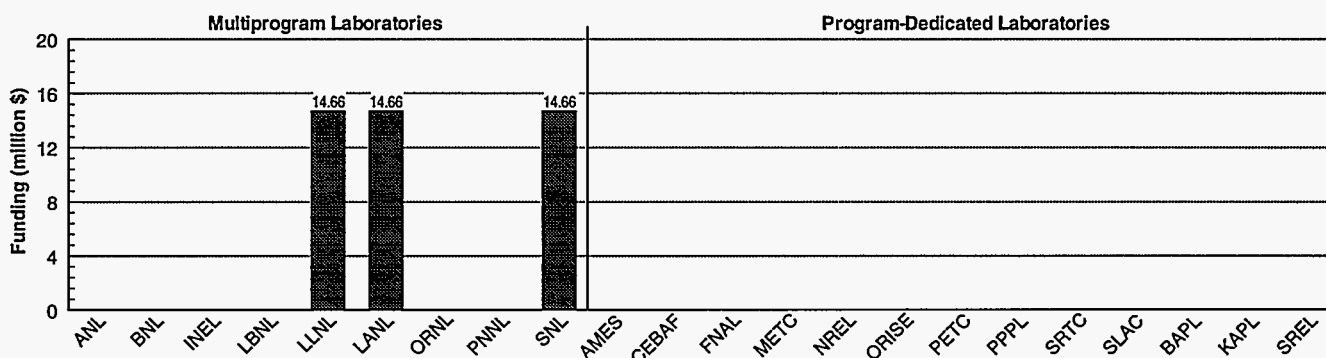
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1996 Funding Profile



Note: This activity was initiated in fiscal year 1996. No previous data are available.

Threat Assessment and Treaty Implementation

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB010316

Laboratory Complex

Principal Laboratories: LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: LANL

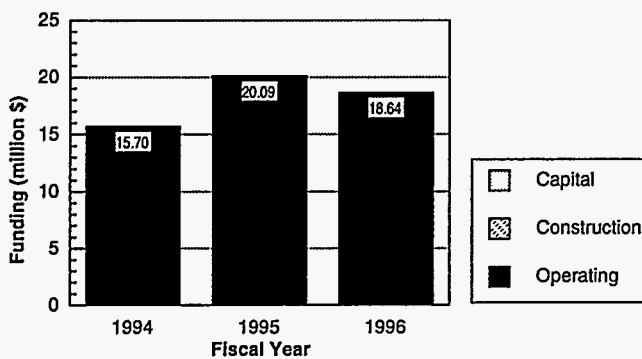
Mission Activity Description

The maintenance of a safe and secure nuclear weapons stockpile is a primary mission of the Department of Energy and its Office of Defense Programs. The Defense Programs laboratories (LLNL, LANL, and SNL) have been and continue to be the foremost authorities on design and construction of nuclear weapons and the conduct of associated research activities.

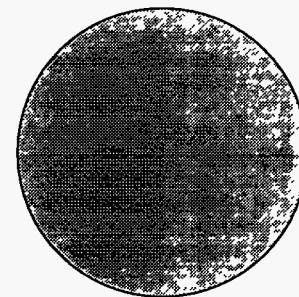
Because of their extensive experience with the characteristics of nuclear weapons programs, the expert staff of the Defense Programs complex, combined with the unique resources of the labs, play an important part in reducing the global danger of nuclear weapon proliferation. Improvements in systems studies, intelligence-related systems research, proliferation-related information management, knowledge preservation, proliferation training, and advice on implications of treaty implementation are all areas where the specialized expertise of the laboratory personnel can make invaluable contributions. Laboratory activities also focus on forging a link between national security programs and the Science-Based Stockpile Stewardship Program by providing assistance in assessing the value of technical developments by foreign powers for proliferation of nuclear weapons.

Additionally, DOE has gained significant insights into the characteristics to be expected of clandestine nuclear programs. This includes knowledge of types of nuclear devices that could be fabricated if an organization gained access to certain materials or technologies. Efforts by the Defense Programs laboratories to reduce the global nuclear danger includes determining methods of response to proliferant nuclear devices. These activities are synergistic with threat assessment research and the Science-Based Stockpile Stewardship Program. Developing proliferation response technologies includes researching technological avenues open to proliferants, detection technologies, and possible neutralization technologies. The Defense Programs laboratories also work in concert with other DOE offices to resolve difficult and sensitive issues in response to known and possible proliferant action.

Funding History



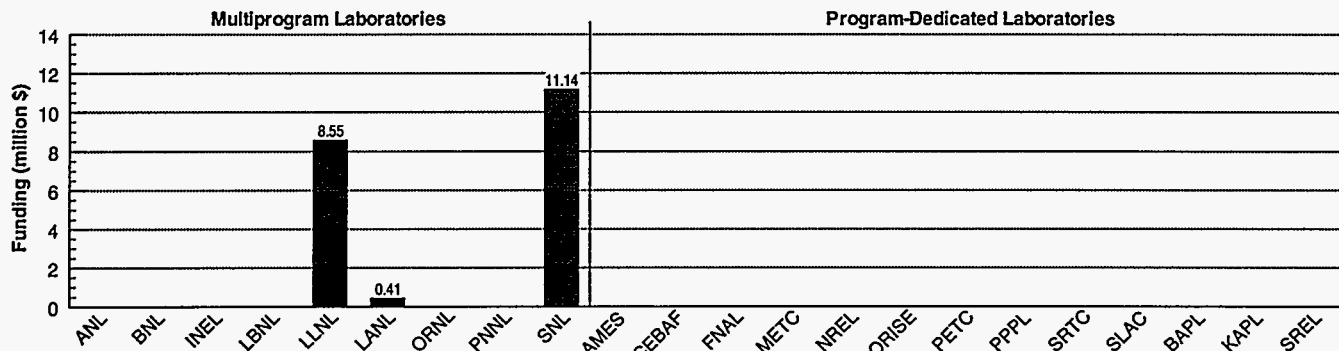
Laboratory-Academia-Industry Participation



Laboratories 100%

FY 1995 Data

Fiscal Year 1995 Funding Profile



Conceptual Design and Assessment

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103221

Laboratory Complex

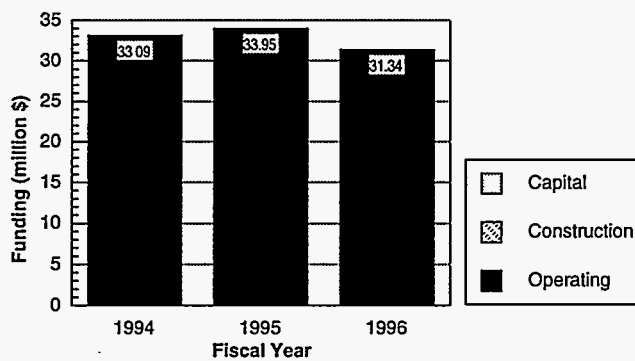
Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: ANL, ORNL

Mission Activity Description

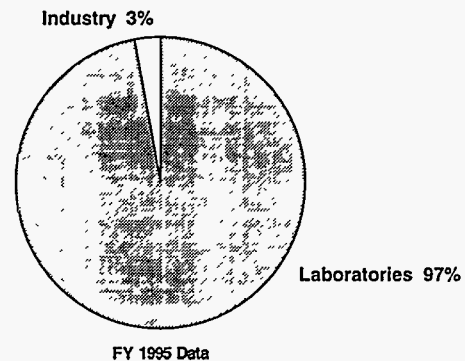
The Department of Energy has responsibility for the Nation's nuclear weapons stockpile, and its Defense Programs laboratories were established to design, develop, and test nuclear weapons. A primary function of these labs, in keeping with their mission, has always been to explore concepts and technologies that offer potential options for meeting future national security requirements. The curtailment of underground testing and cessation of directed nuclear weapon development activity did not relieve Defense Programs of the responsibility for retention of the core capability at the laboratories to conduct conceptual design and assessment activities. Maintenance of this core capability is critical because the scientists who carry out this research will participate in peer reviewed revalidation of weapons systems after the systems undergo rework.

The Conceptual Design and Assessment activity looks beyond proven concepts and outside of traditional methods, providing the new ideas needed to evolve and improve the stockpile, to anticipate and then meet the evolving needs of the military, and to maintain technological superiority. The boundary between conceptual design and assessment and formal development programs is not well defined, but concepts developed by this program are supported only through a "proof of principle" demonstration. When a new concept matures to the point of inclusion in a formal directed study, the concept is transferred into a program outside of the Core Research Program. These activities do not involve formal hardware development, but may include a limited amount of prototyping to demonstrate conceptual feasibility. A sample of the work conducted in support of this Core Research Program includes: (1) benchmarked new computational methods for hydrodynamic instabilities; (2) using the Los Alamos Neutron Science Center (LANSCE) for a study of high explosive microstructure and aging effects using small angle neutron scattering; and (3) incorporated Smooth Particle Hydrodynamics (SPH) into finite element code yielding a new, unique capability to model very high deformation impulsive loading.

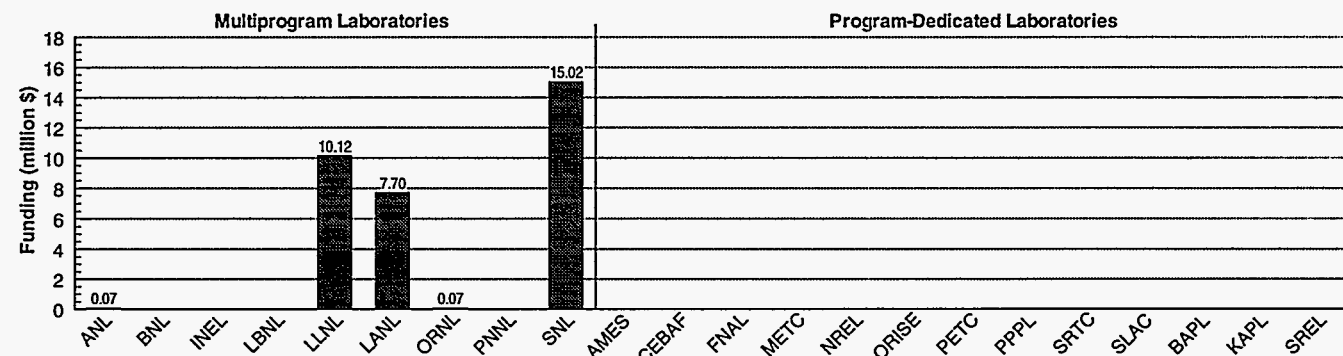
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Physics

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103222

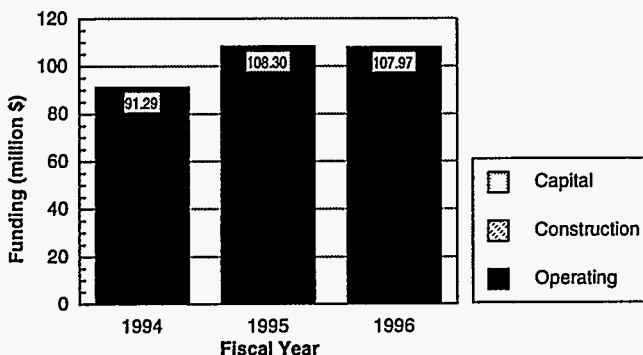
Laboratory Complex

Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: None

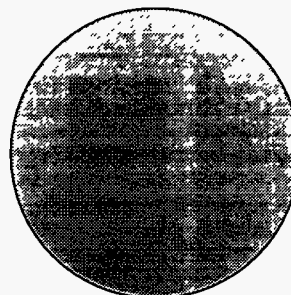
Mission Activity Description

The maintenance of a safe and secure nuclear weapons stockpile is a primary mission of the Department of Energy. Physics principles largely govern the behavior and performance of nuclear weapons and thus the Physics activity plays a critical role in the maintenance of a safe and reliable of U.S. nuclear deterrent. This Core Research and Advanced Technology Program element, supporting the Science-Based Stockpile Stewardship Program, nurtures the essential scientific underpinnings needed to evaluate complex nuclear weapons systems and subsystems. It provides the foundation for many of the unique facilities and capabilities used to test and evaluate these systems and sustains basic weapons physics research for both nuclear and nonnuclear components. Basic and applied research in physics supplies both the theoretical models and experimental data for design and evaluation codes that simulate weapon performance, provide improved predictive capabilities, and allow the development of new concepts, all of which form the basis for ensuring that the stockpile is safe, secure, and reliable. Physics experiments furnish the computer code benchmarks that are the foundation of Science-Based Stockpile Stewardship. Great improvement in existing predictive capability is needed to ensure that a modified or new weapon will function as intended and to gain confidence that permissible hydrodynamic, or dynamic testing will be sufficient to ensure the continuing credibility of the stockpile. Physics research addresses the issues that appear to be some of the most challenging to the U.S. Nuclear Weapon Program. Issues involving hydrodynamics, radiation physics, plasma physics, nuclear physics, solid-state physics, optical physics, and chemical physics are being addressed, and provide for important basic understanding, code validation, and sustain the skills of theoretical and experimental scientists critical to Science-Based Stockpile Stewardship.

Funding History



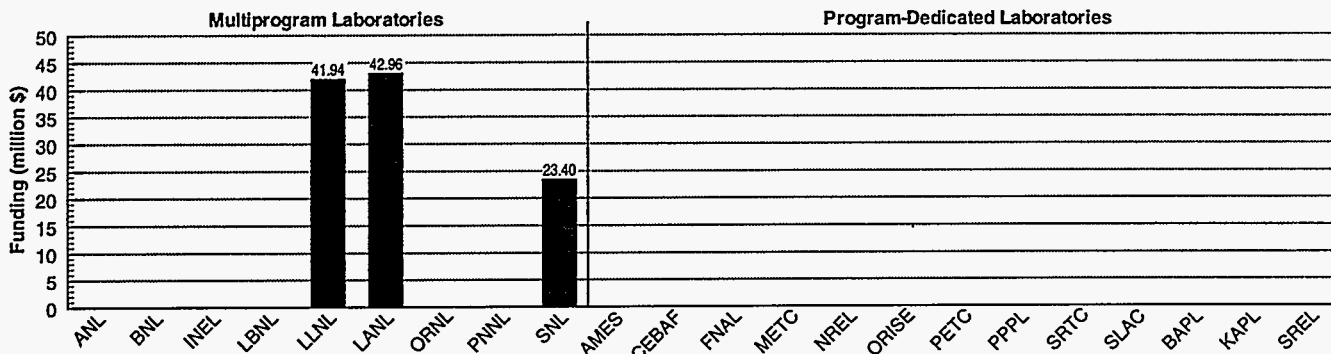
Laboratory-Academia-Industry Participation



Laboratories 100%

FY 1995 Data

Fiscal Year 1995 Funding Profile



Computation and Modeling

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103223

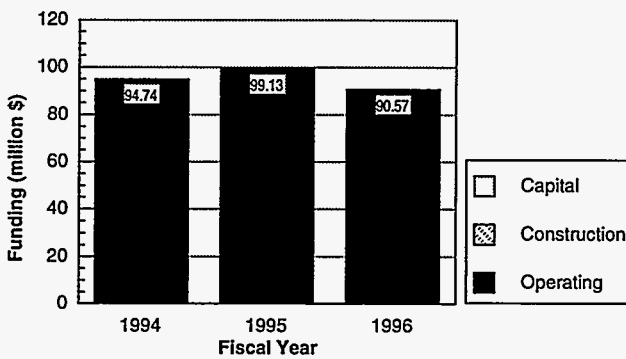
Laboratory Complex

Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: None

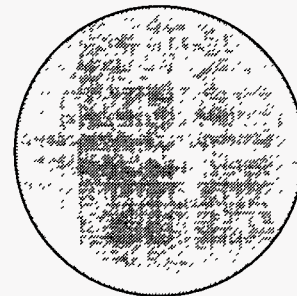
Mission Activity Description

The maintenance of a safe and secure nuclear weapons stockpile is a primary mission of the Department of Energy. Because nuclear weapons systems are extremely complex systems, computation and modeling are indispensable tools in performance of that mission and are invaluable in all aspects of nuclear weapon R&D. Computation and modeling refers to the use of computers and mathematical algorithms to solve intricate problems and predict or explain phenomena that occur during the detonation of a nuclear weapon. Simulation and modeling reduce risks, requirements for physical testing, and the time needed to complete involved calculations, thus decreasing overall program costs. In the absence of underground testing, this area represents the only method of validating performance predictions for weapon modifications and for revalidating modified systems. The Computation and Modeling activity provides a core capability of the Stockpile Stewardship program, and virtually all elements of the Science-Based Stockpile Stewardship Program rely heavily on computation and modeling capabilities to expedite completion of research activities. A sample of computation and modeling includes (1) completion of a major nuclear weapon safety calculation with the 1840-node SNL Paragon Massively Parallel Computer; (2) improvements to physics models, numerical solution algorithms and computer science techniques in 2-dimensional (2D) and 3-dimensional (3D) weapons design, analysis, and output codes; (3) demonstration of scalable parallel execution of coupled geophysical fluid dynamics application code tested on Meiko CS-2, Cray T3D, and IBM SP2-2-A mainframes; and (4) modification of several 2D weapons codes to operate on scientific workstations to determine if they might be cost-effective alternatives to traditional vector supercomputers for 2D simulation.

Funding History

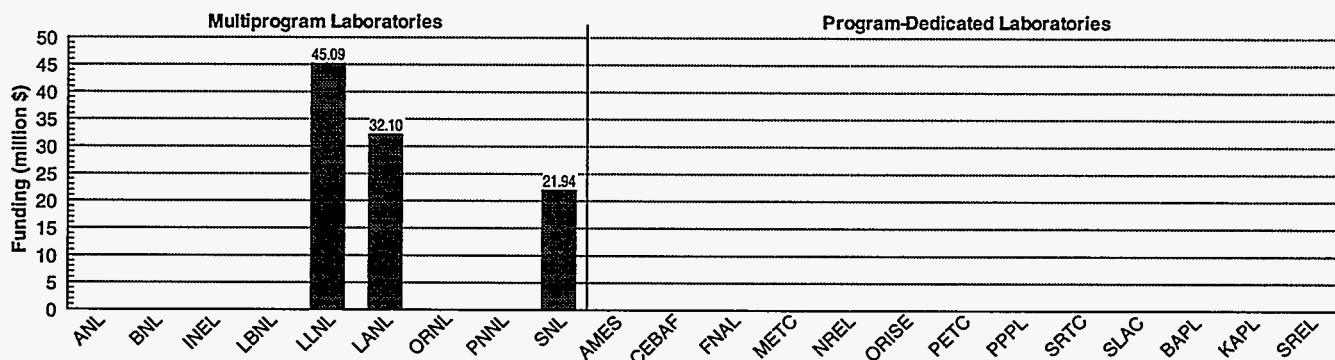


Laboratory-Academia-Industry Participation



FY 1995 Data

Fiscal Year 1995 Funding Profile



Systems Engineering

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103231

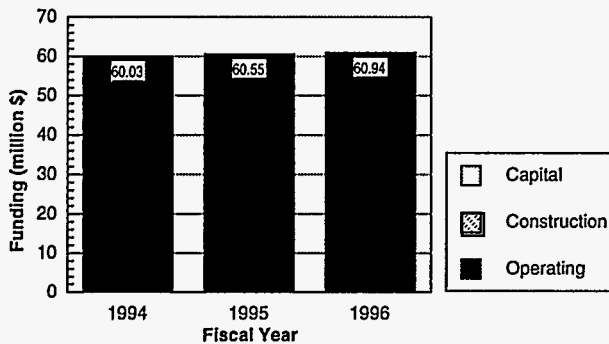
Laboratory Complex

Principal Laboratories: SNL
Contributing Laboratories: None
Participating Laboratories: LANL, LLNL

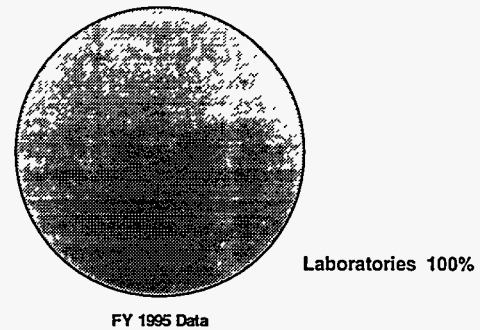
Mission Activity Description

The Department of Energy has responsibility for the Nation's nuclear weapons stockpile, and its Defense Programs laboratories were established to design, develop, and test nuclear weapons. Systems engineering is a critical component of Stockpile Stewardship in the maintenance of a safe and reliable nuclear weapons stockpile. The Systems Engineering activity refers to efforts to integrate multiple/new technologies and to package necessary components and capabilities in the volume prescribed by the Department of Defense for a weapon system, both initially and when making modifications. Efforts in systems engineering include demonstration of emerging technologies, improving command and control, and fabricating performance instrumentation. SNL performs the majority of the Systems Engineering tasks associated with the weapons program. This is due to its overall responsibility for the nonnuclear portion of the weapon system. It has the technology base, infrastructure, and experienced personnel required to efficiently conduct research and development in this area. Activities are divided into three broad areas: surety assessments and technology, exploratory studies and technology, and engineering and testing infrastructure. LLNL and LANL each have smaller programs in Systems Engineering. Their primary responsibilities are the physics packages, but there is some overlap with Systems Engineering. A sample of the activities conducted in the Systems Engineering program includes (1) development of a failure analysis expert system for neutron generators; (2) validation of the nuclear detonation detection system augmentation payload for use on future global positioning system (GPS) satellites; (3) developed an inspection station for enhanced surveillance and part requalification; and (4) demonstration of the feasibility of nondestructive gap thickness in pits.

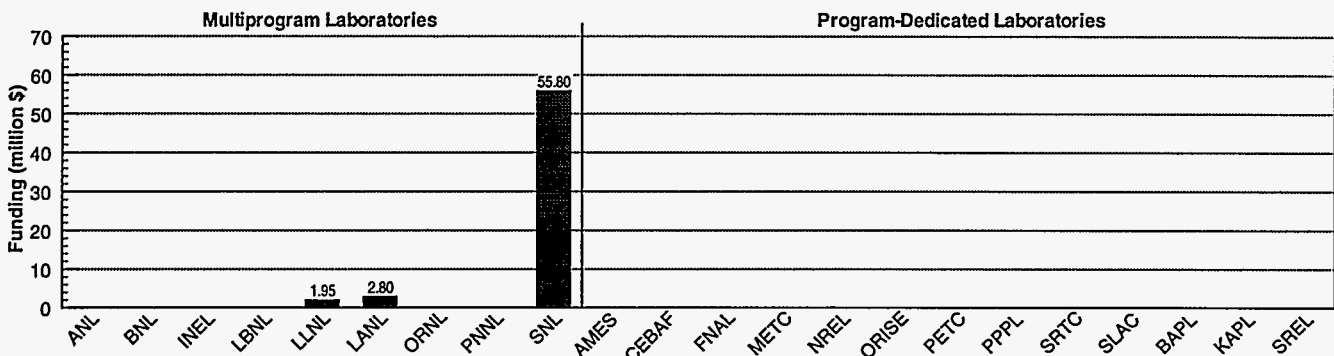
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Electronics, Photonics, Sensors, and Mechanical Components

Department of Energy Program

Program: Defense Programs
 Office: Research and Development
 Element: Research and Inertial Fusion
 B&R Code: GB0103232

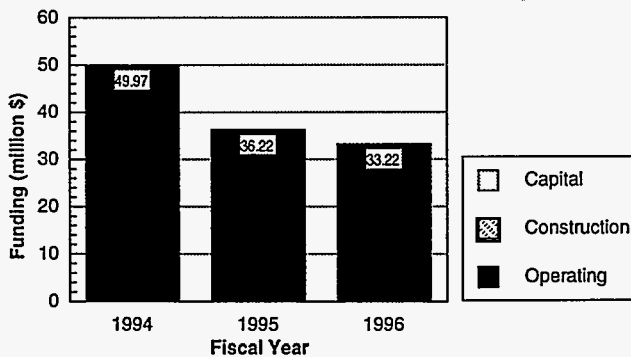
Laboratory Complex

Principal Laboratories: SNL
 Contributing Laboratories: LLNL
 Participating Laboratories: None

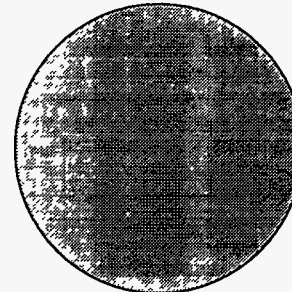
Mission Activity Description

The Department of Energy has responsibility for the Nation's nuclear weapons stockpile, and its Defense Programs laboratories were established to design, develop, and test nuclear weapons. The Electronics, Photonics, Sensors, and Mechanical Components activity of the Core Research and Advanced Technology Program supports Science-Based Stockpile Stewardship and plays a key role in maintenance of a safe and reliable nuclear weapons stockpile. Many of the requirements for electronic devices in nuclear weapon applications cannot be met with commercial products. This is also true for many of the photonic, mechanical, and aerodynamic components. Taken together, these components largely determine the reliability of the weapon after an extended period of time in the stockpile, as well as the maintenance requirements of weapons in the stockpile. Consequently, innovations in these areas are driven by DOE defense requirements and have important life-cycle cost benefits. Research is conducted in the enabling technologies for components and subsystems that control and operate nuclear weapons, and in intelligent systems that monitor and diagnose the condition of weapons with regard to aging, functional status, intrusion or tamper detection, and anticipated performance. Emphasis is on devices used in conjunction with microelectronic systems that can offer the following: improved safety, security, reliability and information processing; improved safety in abnormal environments; enhanced command and control; automated monitoring and inventory control; command disablement, and intelligent manufacturing based on the use of robotics. Activities at the laboratories are divided into ten broad areas: electronic subsystems, electronics components, packaging and interconnects, reliability and certification, photonic materials, photonic devices, photonic subsystems, mechanical components, aerodynamic components, and sensors.

Funding History



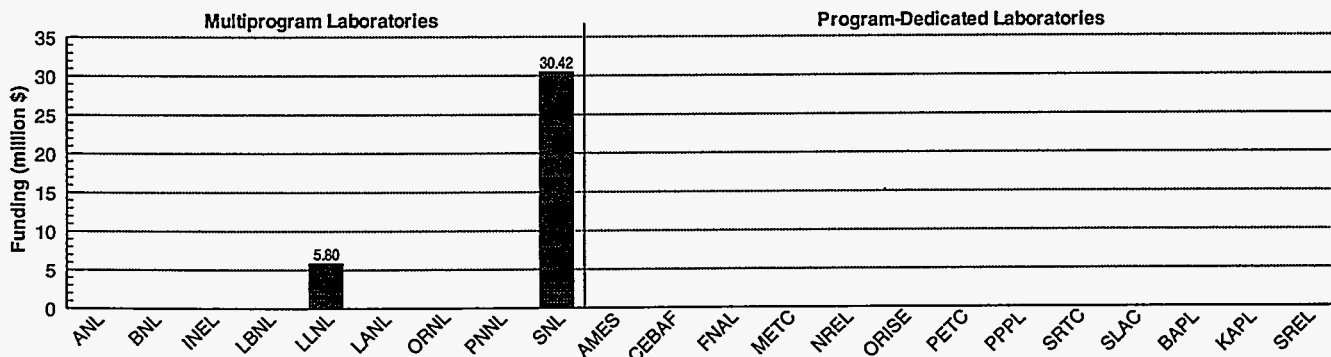
Laboratory-Academia-Industry Participation



Laboratories 100%

FY 1995 Data

Fiscal Year 1995 Funding Profile



Advanced Manufacturing Technology Development

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103233

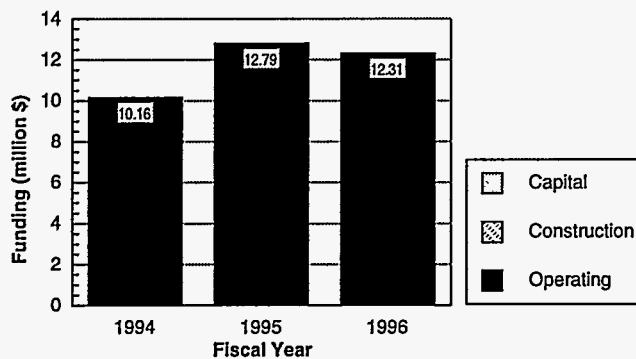
Laboratory Complex

Principal Laboratories: LANL, SNL
Contributing Laboratories: None
Participating Laboratories: LLNL

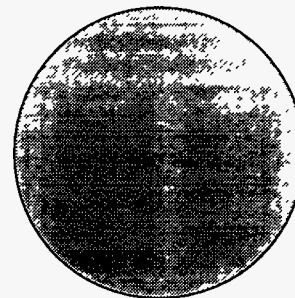
Mission Activity Description

The technical goals of the Advanced Manufacturing Technology Development activity support the Department of Energy mission of "providing the technical information and the scientific and educational foundation for ... a secure national defense." Manufacturing research expertise at the DOE weapons labs will enable Science-Based Stockpile Stewardship to develop a knowledge base that supports future manufacturing requirements. This knowledge base will help ensure an enduring national capability to rapidly and effectively manufacture components or entire weapons. The laboratories will become manufacturing science and technology leaders for small-lot, inherently safe, ultrareliable systems and components by leveraging advances in chemistry and materials, engineering sciences, information sciences, and fabrication technology. This activity supports the change of the basis of U.S. nuclear deterrence, from one based on capacity to one based on capability, relying on a much smaller stockpile, and enhancing the ability to produce limited numbers of remanufactured components or weapons. Efforts in this activity address the loss of the ability to replicate (due to environmental concerns, loss of vendor, etc.) the manufacturing processes that were originally used to produce systems currently in the stockpile. Component fabrication research supports the process of making small batches of components with the same quality, reliability, and performance achievable through a fully automated production line, but without the benefit of special tooling, trial runs, and a massive database of statistical evidence to track trends and adjust processes. To compensate for the lack of statistical process data during small lot production, post-process part inspection must be replaced by in-process or process intermittent gauging. To make full use of this information requires advanced machine control technology. Thus, intelligent machines and robotics form an integral part of flexible manufacturing.

Funding History



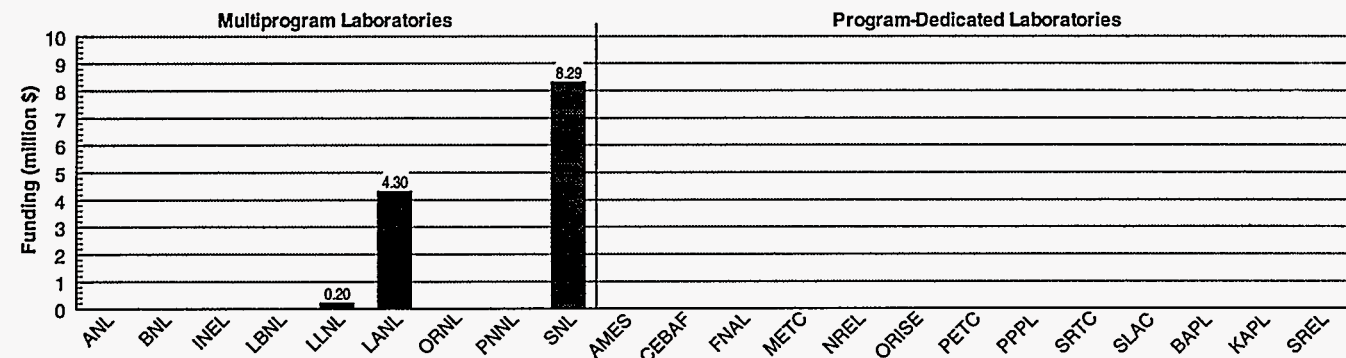
Laboratory-Academia-Industry Participation



Laboratories 100%

FY 1995 Data

Fiscal Year 1995 Funding Profile



Chemistry and Materials

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103241

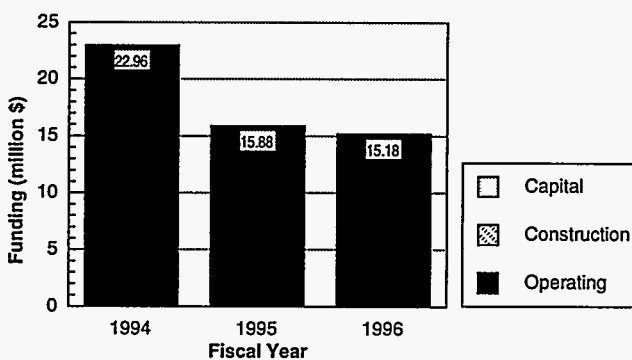
Laboratory Complex

Principal Laboratories: SNL
Contributing Laboratories: LANL, LLNL
Participating Laboratories: None

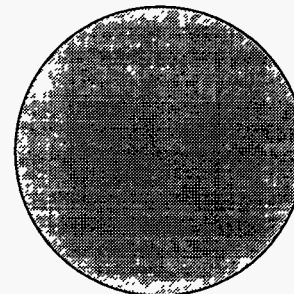
Mission Activity Description

The Department of Energy has responsibility for the Nation's nuclear weapons stockpile, and its Defense Programs laboratories were established to design, develop, and test nuclear weapons. Meeting the demanding reliability, safety, and physical security requirements of nuclear weapons requires a diverse range of materials expertise and capabilities. The Chemistry and Materials activity supports Stockpile Stewardship and carries out research in materials synthesis and processing, determines materials structure and composition, and develops functional properties in polymers, metals, ceramics, inorganic and organic materials, and composites. The safety and reliability of the enduring U.S. nuclear weapons stockpile rely directly on the results of this research. These activities are required to address the resolution of weapons aging and reliability issues, to support the remanufacture of stockpile components in a timely, cost effective and environmentally benign way and to enhance the reliability and surety of remanufactured components. Pertinent objectives include maintenance of engineering competence in this unique set of materials science, development of models to study aging phenomena, and development of low toxicity alternative materials to reduce environmental, safety and health concerns associated with weapons production, maintenance and dismantlement. Addressing the critical need to improve the understanding of aging and how it will affect nuclear weapons is a major science and technology challenge. Significant investment leverage is realized by the expanded chemistry and materials technologies mission, which includes working with industry to conduct research of mutual interest, Department of Defense conventional munitions, environmental cleanup, and energy research. Stockpile maintenance and Science-Based Stockpile Stewardship efforts require an extensive chemistry and materials technology base that requires continued Defense Programs investment in these areas at all three Defense Programs laboratories.

Funding History

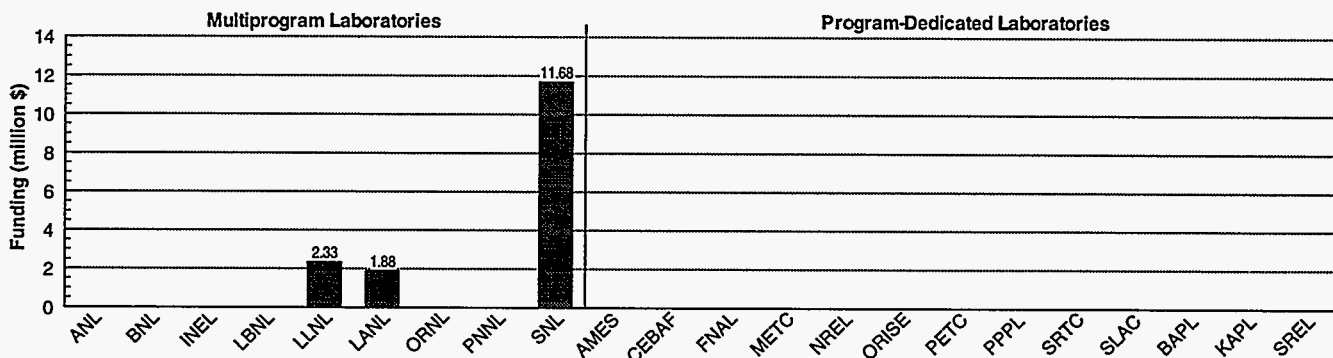


Laboratory-Academia-Industry Participation



FY 1995 Data

Fiscal Year 1995 Funding Profile



Los Alamos Neutron Science Center

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: G30103013

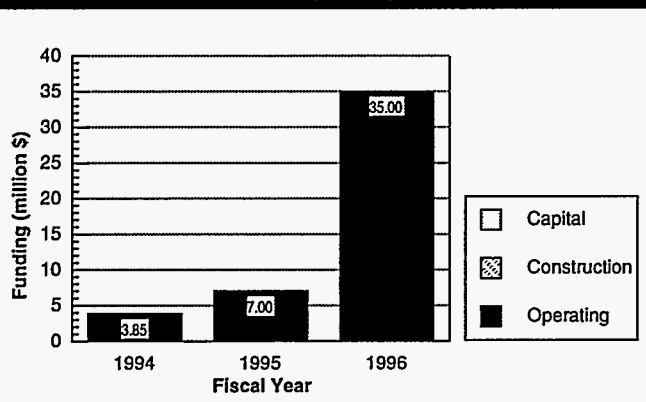
Laboratory Complex

Principal Laboratories: LANL
Contributing Laboratories: None
Participating Laboratories: None

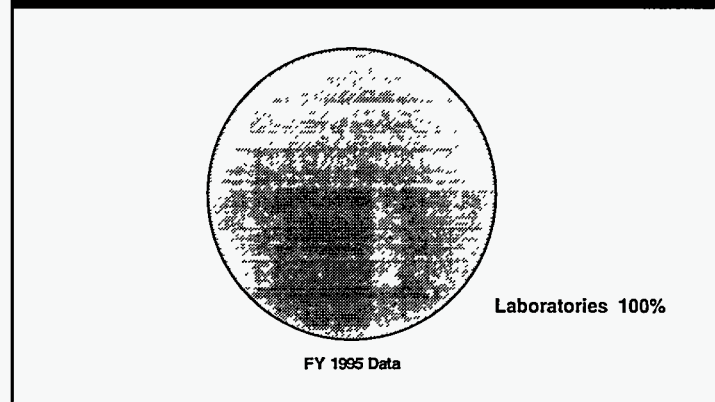
Mission Activity Description

The Department of Energy has national security as one of its primary missions, and the maintenance of a safe and secure nuclear weapons stockpile is one of the major subsets of this mission. The Science-Based Stockpile Stewardship program is one of the methods DOE will use to achieve that mission. To determine how the increasing age of the weapons is affecting their safety and reliability, it is necessary to perform detailed examinations of the materials in the weapons. Conventional radiography methods alone will not provide the detailed information needed. To recognize the fact of its importance to the national security mission, ownership of the Los Alamos Neutron Science Center (LANSCE) was transferred from Energy Research to Defense Programs on October 1, 1995. LANSCE will make a significant contribution to the safety, reliability, and longevity of the enduring U.S. nuclear weapons stockpile. It provides a new source of critical data in the detection of small-scale material defects that may well serve as indicators of weapon component aging and in prediction of material performance. Science-Based Stockpile Stewardship experiments in the following areas will benefit from the commencement of operations at LANSCE: utilization of neutron and proton radiography for nondestructive surveillance, modeling of weapons materials science properties, characterization of high explosive properties, examination of the plutonium equation of state, taking measurements for nuclear forensics and characterization of damage for inertial confinement fusion applications. A sample of the LANSCE activities includes the following: (1) demonstration of the feasibility of temperature measurements in high explosives with single-pulses of resonance energy neutrons; (2) start of measurements aimed at characterizing material textures in stockpile return and new-process weapons components; and (3) start of the study of high-explosive microstructure and aging effects using small-angle neutron scattering.

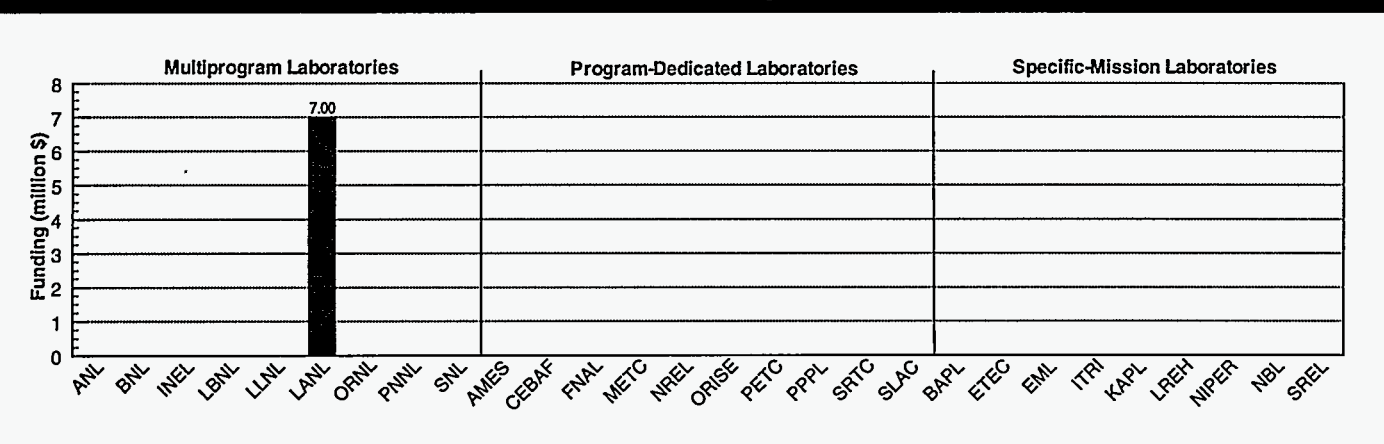
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



High Explosives

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103241

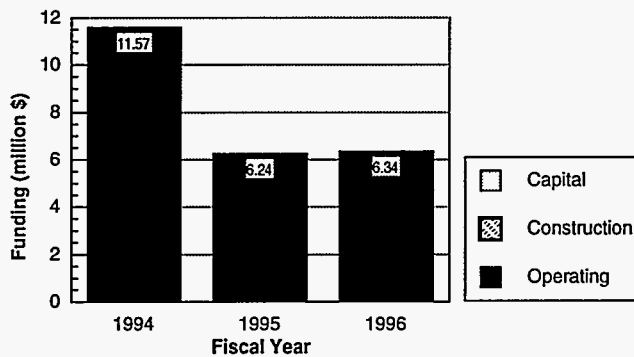
Laboratory Complex

Principal Laboratories: LANL, LLNL
Contributing Laboratories: None
Participating Laboratories: None

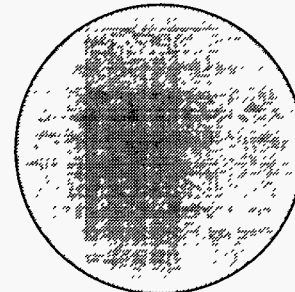
Mission Activity Description

The Department of Energy has national security as one of its primary missions, and maintenance of a safe and secure nuclear weapons stockpile is one of the major subsets of this mission. Energetic materials, formulated as explosives, propellants, and pyrotechnics, are key components in nuclear weapons. The High Explosives activity, as part of the Stockpile Stewardship program, supports the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and modernization as well as reduction of that stockpile. Research activities involve the fundamental physics and chemistry of explosive materials, characterization and modeling of explosive properties, improvement of firing technology, investigation of demilitarization technologies, and engineering of explosive component prototypes and their evaluation for weapons use. Achieving an optimal balance between safety and performance is the major goal of these activities, which seek to provide: more powerful insensitive high explosives, which are highly resistant to unintentional detonation; detonation systems that offer improvement in safety; and answers to questions about the effects of aging on high explosives in stockpiled weapons. Each Defense Programs laboratory has unique facilities which lend themselves to execution of this type of research in support of Science-Based Stockpile Stewardship and maintenance of energetic material core competencies (detonation physics, advanced diagnostics development, chemical synthesis, predictive code development, modeling, aging/compatibility phenomena, and so forth). A representative sample of the activities includes (1) Development of a comprehensive containment vessel strategy for use with high-explosive experiments; (2) Study of fundamental kinetics of molten salt destruction of energetic materials; and (3) Continued efforts in the design and fabrication of a next generation direct optical ignition firing set.

Funding History

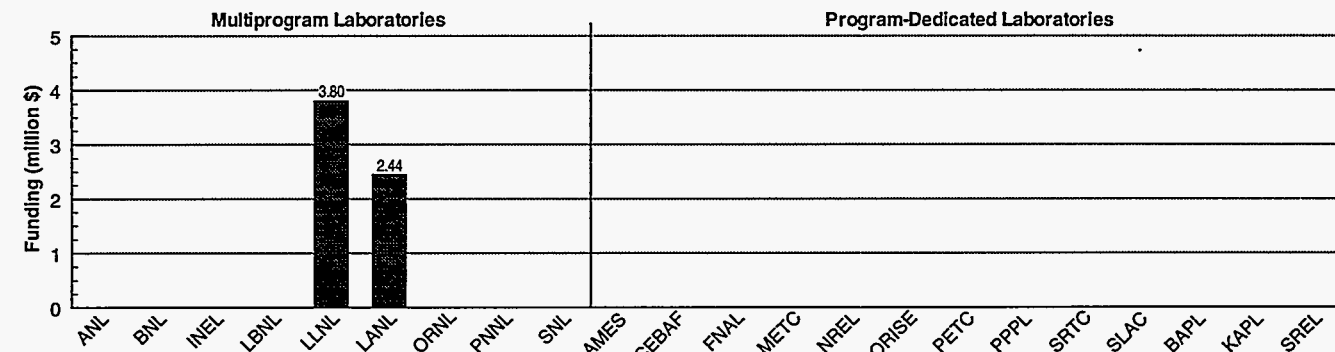


Laboratory-Academia-Industry Participation



FY 1995 Data

Fiscal Year 1995 Funding Profile



Special Nuclear Materials

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103242

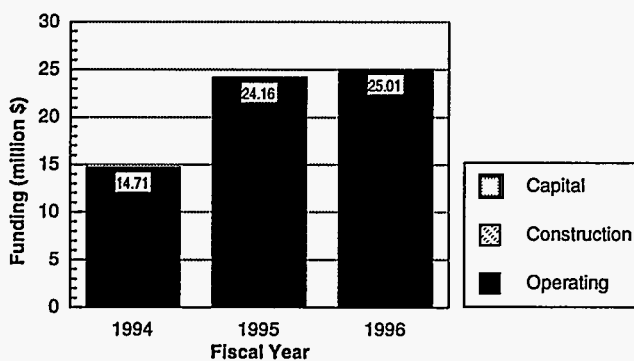
Laboratory Complex

Principal Laboratories: LANL, LLNL
Contributing Laboratories: None
Participating Laboratories: None

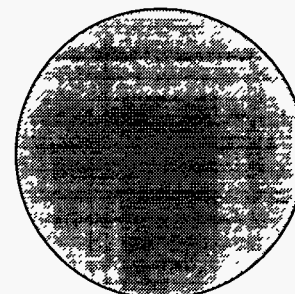
Mission Activity Description

The Department of Energy has national security as one of its primary missions. The Special Nuclear Materials activity, part of the Defense Programs Science-Based Stockpile Stewardship Program effort to maintain a safe and reliable U.S. nuclear weapons stockpile, is concerned with advanced and automated processing, casting, dynamic testing, and machining technologies for lithium salts, plutonium, and uranium. This research supports an enhanced understanding of the physical, mechanical, chemical, and thermodynamic properties of the actinides. Understanding actinide properties is fundamental to the development of environmentally benign fabrication, handling, and storage capabilities. This is a critical research area because most Special Nuclear Materials (SNM) are chemically very reactive, as well as highly radioactive, and require specialized technical expertise and costly facilities to accommodate handling and processing. The United States' capabilities in these areas, including essential expertise in manufacturing, purification, recycling, and waste management, reside principally within the Defense Programs nuclear weapons complex. Treaty agreements, changing stockpile policies, and tighter environmental safety and health regulations have changed the priorities of this program from production to support of the existing stockpile and disassembly activities. Emphasis is currently being placed on recycling procedures, aging effects, precision casting, dry machining, robotic handling, and improved treatment of hazardous by-products and waste. Unique aspects of SNM technology include the processing and use of these materials with full regard for worker and environmental safety and health, cost control, nuclear material and waste management considerations, accurate materials accountability, and safeguards and security. This program element also supports the research and development and infrastructure needed to evolve and maintain core competencies in this technology.

Funding History

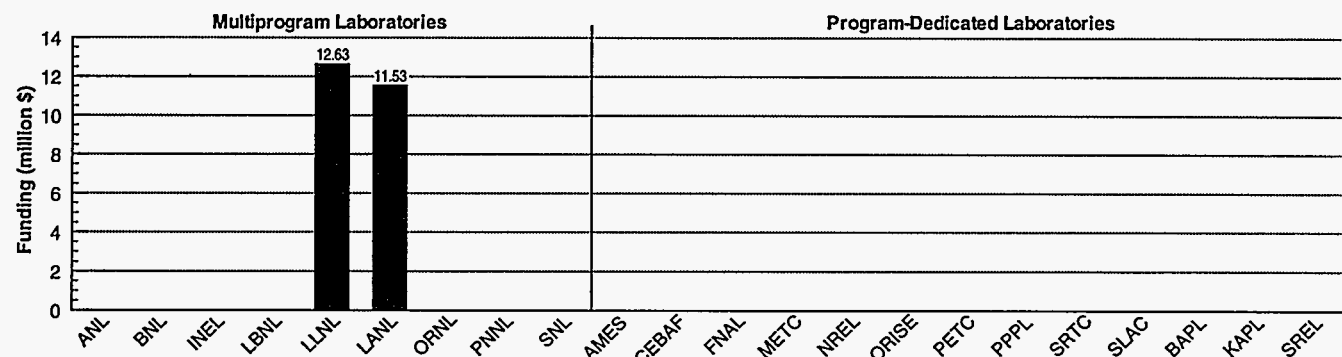


Laboratory-Academia-Industry Participation



FY 1995 Data

Fiscal Year 1995 Funding Profile



Tritium

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0103243

Laboratory Complex

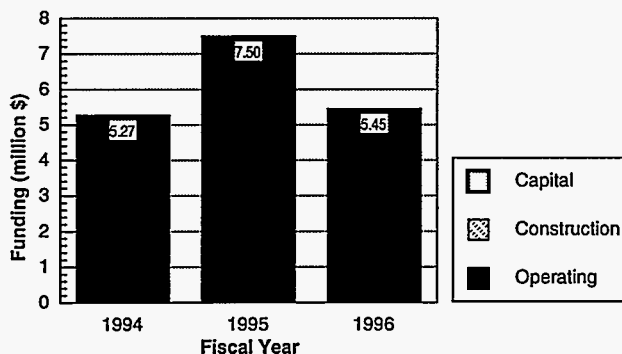
Principal Laboratories: LANL
Contributing Laboratories: LLNL
Participating Laboratories: None

Mission Activity Description

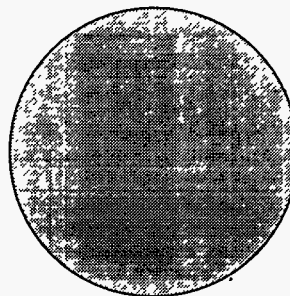
Modern nuclear weapons use a radioactive isotope of hydrogen known as tritium to enhance their yield. To maintain the nuclear weapons stockpile, as directed by the President in the Nuclear Weapon Stockpile Memorandum, the United States requires a reliable source of the isotope. Because tritium has a relatively short radioactive half life of 12.3 years, it must be replenished periodically. Tritium-related research directly affects the safety and reliability of the U.S. nuclear weapons stockpile. Tritium is a critical component in stockpiled nuclear weapons and is also a proposed fuel for inertial fusion targets. Tritium use is complicated by its high chemical reactivity and severe environmental safety and health issues.

The Tritium activity, part of the Defense Programs Science-Based Stockpile Stewardship Program, covers material science research in the production, handling, and use of tritium and its compatibility with other materials and components. There are currently four broad areas of study in this program element: gas transfer systems, solid storage systems, neutron generator tubes, and inertial fusion targets. Tritium has a relatively short half-life and as it decays, it is capable of degradation to the performance of a weapon system's physics package, setting a limit on the stockpile lives of weapon systems utilizing tritium. Research in this area and maintenance of existing facilities will continue to be important as long as weapons systems utilize tritium. A sample of tritium research activities conducted in support of the Core Research Program includes the following: (1) successful operation of a new economical tritium-gathering system that avoids creation of tritiated water during tritium contamination cleanup operations; and (2) design and construction of an Acorn boost system loading manifold at the Weapons Engineering Tritium Facility.

Funding History

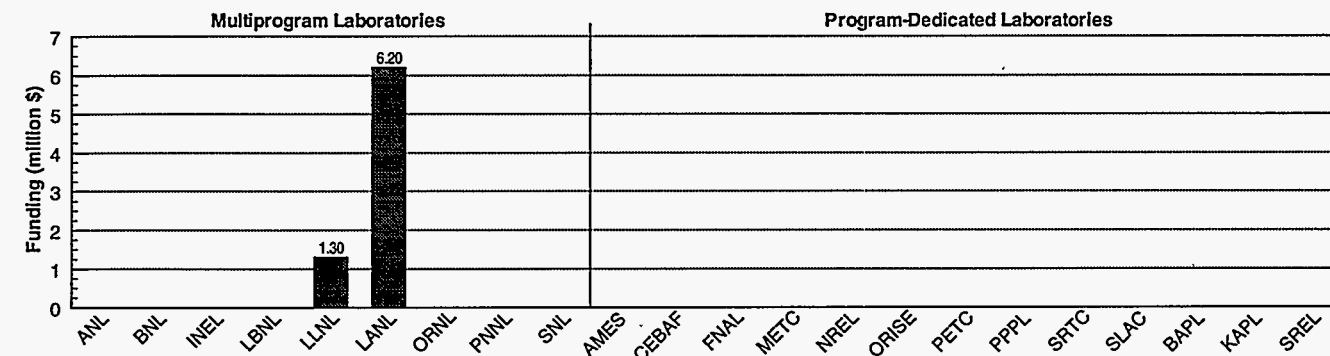


Laboratory-Academia-Industry Participation



FY 1995 Data

Fiscal Year 1995 Funding Profile



Indirect Drive With Glass Laser Driver

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0207

Laboratory Complex

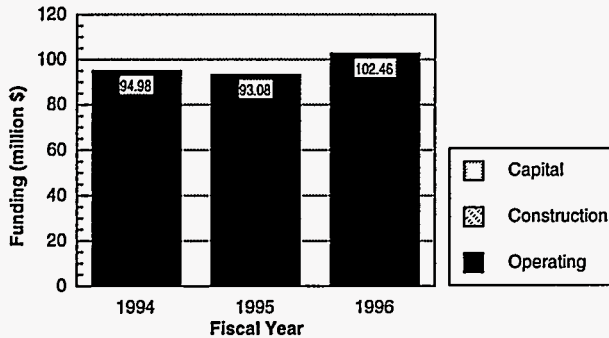
Principal Laboratories: LLNL
Contributing Laboratories: LANL
Participating Laboratories: None

Mission Activity Description

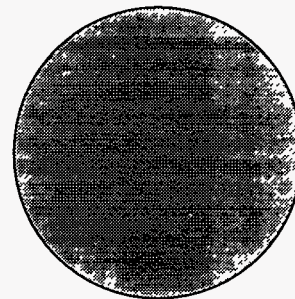
DOE is responsible for continuously keeping the U.S. nuclear weapons stockpile safe and reliable. One of the areas of weapons physics that is least well understood is the fusion reaction. Without the ability to perform underground nuclear tests, fundamental understanding of the fusion reaction becomes critical. Only inertial confinement fusion (ICF) appears to be able to provide the conditions of temperature, density, and time necessary to cause fusion in a laboratory setting. DOE has been investigating this area for many years and has determined three major approaches bear the most promise: glass lasers (direct and indirect drive), gas (krypton fluoride) lasers, and light ion beams. Glass lasers are the most well understood, but the other technologies hold great promise for future fusion facilities.

The Indirect Drive with Glass Laser activity supports the maintenance of a safe, reliable U.S. nuclear weapons stockpile by providing the capability to perform weapon physics experiments and computations to increase the level of confidence in achieving ignition in the laboratory and to support the National Ignition Facility (NIF) project. It includes research and development for the NIF, which will extend the capability for weapon physics and weapon effects. This task includes computational and experimental efforts to investigate the x-ray-driven (indirect drive) approach to ICF. Indirect drive with the glass laser driver is the mainline approach to ICF and is pursued at LLNL with the 10-beam Nova laser and at LANL using the smaller Trident laser facility. This program has already made important contributions to the Science-Based Stockpile Stewardship Program by providing the experimental and computational capability to measure opacity and equation-of-state parameters of high-energy-density plasmas (crucial information for the understanding of thermonuclear weapon performance). The NIF design is based on this driver technology.

Funding History

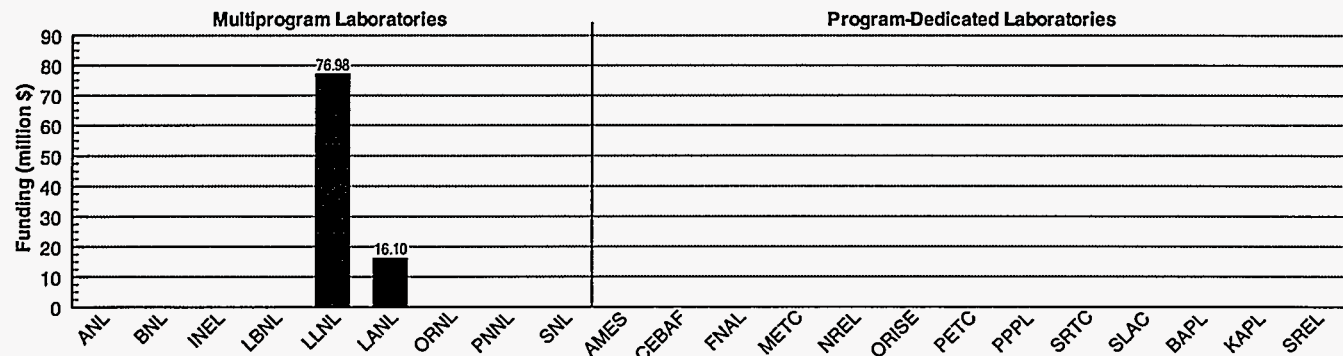


Laboratory-Academia-Industry Participation



FY 1995 Data

Fiscal Year 1995 Funding Profile



Direct Drive With Glass Laser Driver

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0208

Laboratory Complex

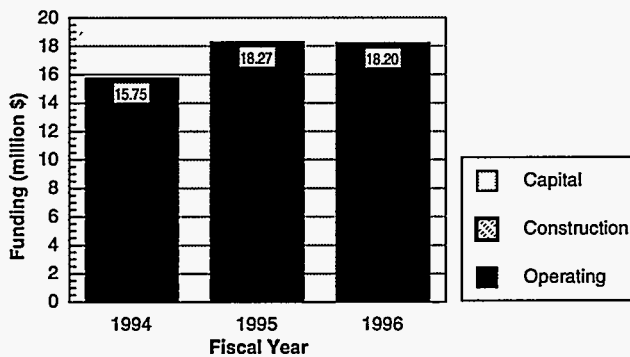
Principal Laboratories: None
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

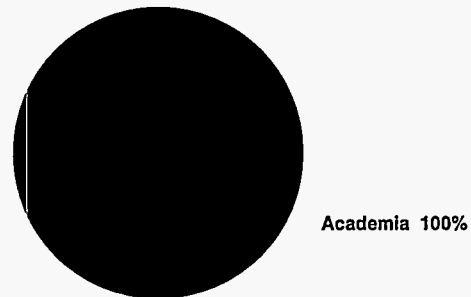
DOE is responsible for continuously keeping the U.S. nuclear weapons stockpile safe and reliable. One of the areas of weapons physics that is least well understood is the fusion reaction. Without the ability to perform underground nuclear tests, fundamental understanding of the fusion reaction becomes critical. Only inertial confinement fusion (ICF) appears to be able to provide the conditions of temperature, density, and time necessary to cause fusion in a laboratory setting. DOE has been investigating this area for many years and has determined three major approaches bear the most promise: glass lasers (direct and indirect drive), gas (krypton fluoride) lasers, and light ion beams. Glass lasers are the most well understood, but the other technologies hold great promise for future fusion facilities.

The Direct Drive with Glass Laser research supports the Science-Based Stockpile Stewardship Program in maintenance of a safe and reliable U.S. nuclear weapons stockpile. It utilizes Omega, the highest power laser with the best optical quality available, for performing high-energy-density experiments that can be used to assess the viability of direct drive for the National Ignition Facility (NIF). This approach to ICF is complementary to the indirect-drive approach and may prove to be more efficient than the indirect-drive option. The direct-drive approach to ICF can potentially provide higher gain for the same driver energy as the indirect-drive approach. The Omega facility, which is built to use the direct-drive concept, will also become the test bed for many NIF-related experiments, as well as for investigating pulse shaping and bandwidth requirements. Weapons physics scientists will increasingly rely on Omega until the NIF is available. The educational and outreach function at the University of Rochester Laboratory for Laser Energetics (UR/LLE) will make available highly competent, skilled scientists for the ICF program and the weapons program in support of the national security mission. Currently, scientists trained at UR/LLE play important roles in the LLNL laser technology development program, in Nova experiments, and on the NIF design team.

Funding History



Laboratory-Academia-Industry Participation



FY 1995 Data

Note: All funding goes to University of Rochester.

Fiscal Year 1995 Funding Profile

No DOE laboratory funding

Krypton Fluoride Laser

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0209

Laboratory Complex

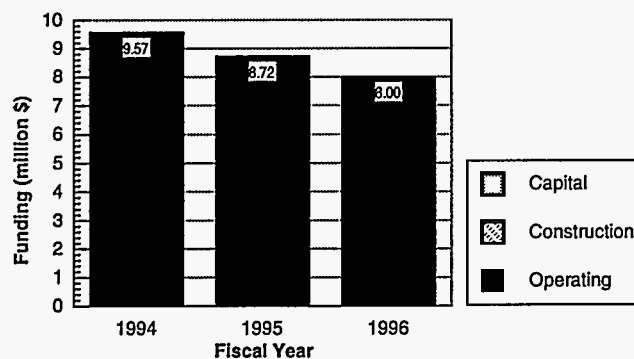
Principal Laboratories: LANL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

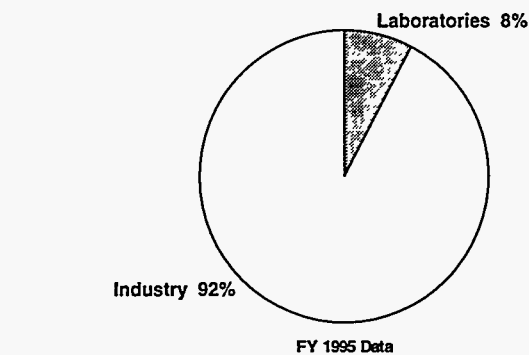
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The krypton fluoride (KrF) laser is a short-wavelength laser with enhanced beam uniformity and efficiency. With ultra-smooth broad-bandwidth beams, research utilizing the Nike KrF laser at the Naval Research Laboratory (NRL) supports the maintenance of a safe and reliable U.S. nuclear deterrent by providing a unique capability for measuring hydrodynamic instability and mixing, an important phenomenon in ICF and weapons performance. Laser experiments on the Nike laser concentrate on acceleration of planar targets on a low isentrope to define beam smoothness requirements for direct drive. Of immediate importance to the National Ignition Facility (NIF) design and the Science-Based Stockpile Stewardship Program are Nike's near-term capability for flat target studies of imprinting and bandwidth effects on targets. Research at NRL provides critical innovations for enhancement of laser driver performance and capabilities in code development and atomic physics, both essential to the mission of ICF. KrF laser technology may be extrapolated to a fusion reactor scenario because it can be repetitively pulsed and it is relatively efficient.

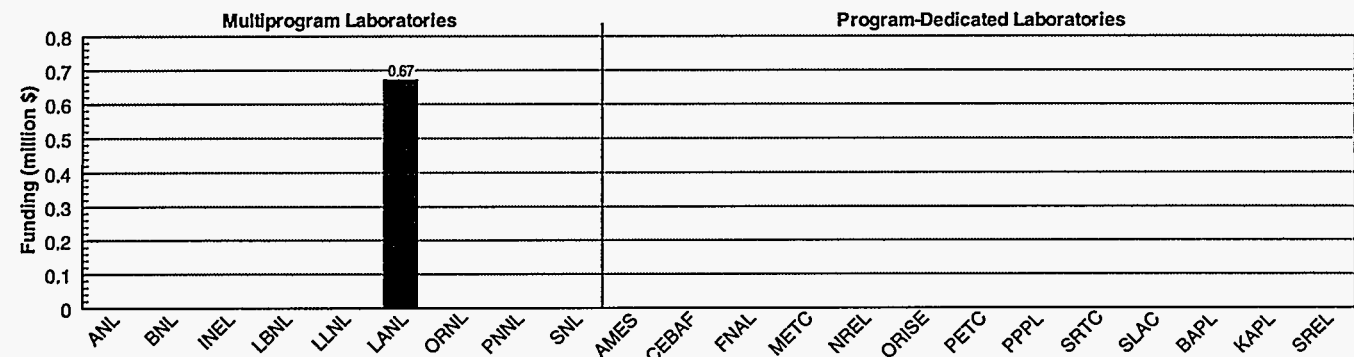
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Light Ion Beams

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0210

Laboratory Complex

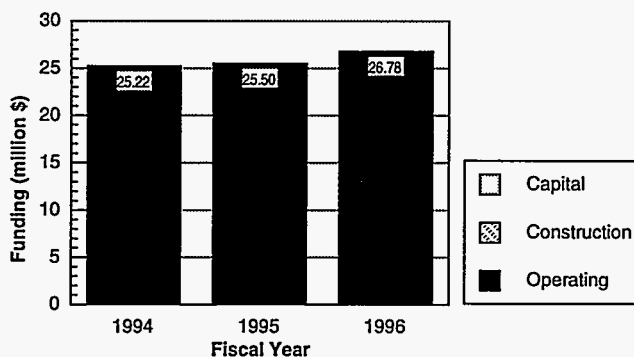
Principal Laboratories: SNL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

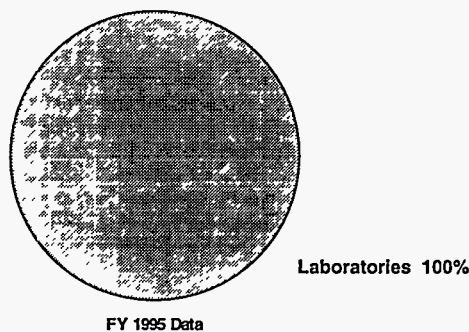
DOE is responsible for continuously keeping the U.S. nuclear weapons stockpile safe and reliable. One of the areas of weapons physics that is least well understood is the fusion reaction. Without the ability to perform underground nuclear tests, fundamental understanding of the fusion reaction becomes critical. Only inertial confinement fusion (ICF) appears to be able to provide the conditions of temperature, density, and time necessary to cause fusion in a laboratory setting. The Department of Energy has been investigating this area for many years and has determined three major approaches bear the most promise: glass lasers (direct and indirect drive), gas (krypton fluoride) lasers, and light ion beams. Glass lasers are the most well understood, but the other technologies hold great promise for future fusion facilities.

The Light-ion Beams activity contributes to the ICF mission through its work on ion beams in support of an eventual high-yield capability; through the availability of ICF-developed facilities for radiography and for production of intensely radiating z-pinch plasmas that are used for both nuclear weapon effects testing and large-scale hohlraum experiments; and through direct support for National Ignition Facility (NIF) development. In the light-ion approach to ICF, electrical energy from a pulsed-power accelerator is coupled to a magnetically insulated diode to create an intense beam of light ions that can be focused onto a target. The principal facility for light-ion experiments is the Particle Beam Fusion Accelerator II (PBFA II) pulsed-power accelerator at SNL. Pulsed-power technology is being pursued as possibly the best approach to high target gain because of its efficiency, relatively low cost, and favorable energy deposition characteristics. Z-pinch experiments conducted and code development undertaken, including 3-dimensional hydrodynamics and particle-in-cell codes, are expected to provide important data for the NIF and for weapon science, in direct support of the ICF mission.

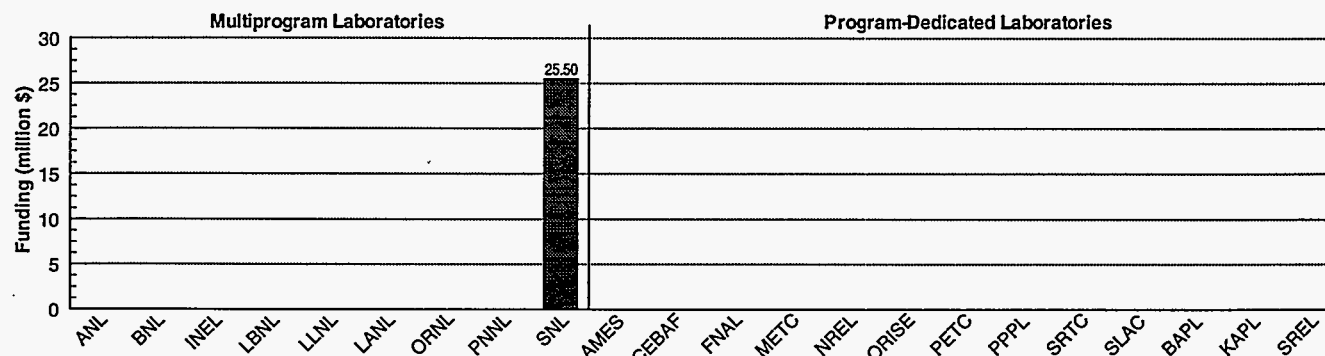
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Capsule Fabrication and Development

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB0211

Laboratory Complex

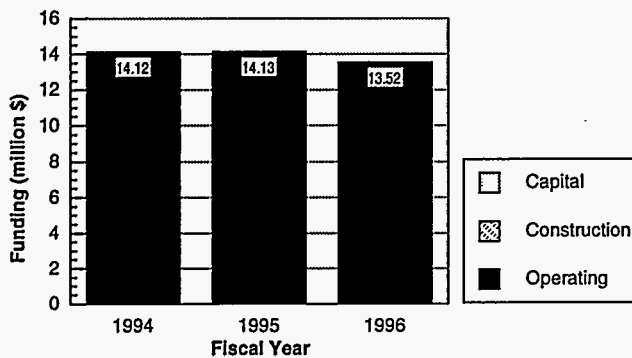
Principal Laboratories: LANL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

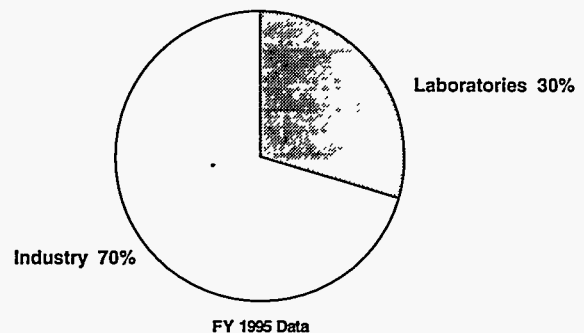
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Capsule fabrication and development is essential to the ICF program and maintenance of the U.S. nuclear weapons stockpile. This program seeks to develop and assemble ignition targets and the associated cryogenic technologies and systems for the ICF program. Research efforts include the development, manufacture, and metrology of various complex, well-characterized, indirect- and direct-drive targets and target components. An ignition target consists of a millimeter-scale, fuel-containing spherical capsule which (for indirect drive) may be enclosed in a vacuum- or gas-filled radiation case called a "hohlraum"; mounted with a low-mass fiber web; or mounted in a low-density foam-filled hohlraum. Ignition target designs require cryogenic fuel in the capsules. Technological challenges include: producing capsules with cryogenic layers of sufficient smoothness and uniformity, maintaining targets at cryogenic temperature during transportation to the center of an evacuated target chamber, and performing final alignment. Achievement of target fabrication goals, especially in the area of cryogenic targets, is critical to achieving thermonuclear ignition and burn in the laboratory.

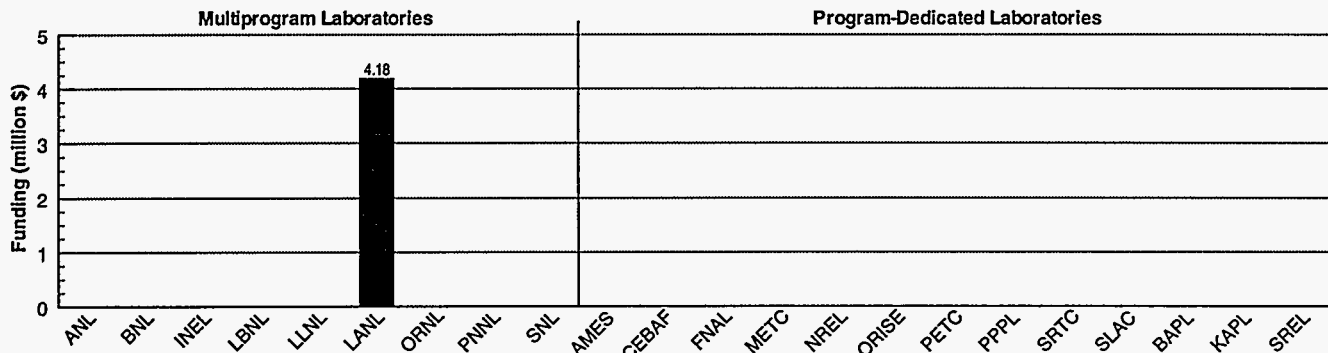
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



National Ignition Facility

Department of Energy Program

Laboratory Complex

Program: Defense Programs
Office: Research and Development
Element: Research and Inertial Fusion
B&R Code: GB021202

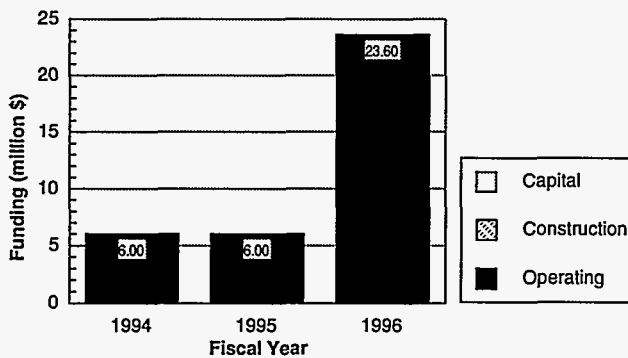
Principal Laboratories: LLNL
Contributing Laboratories: ANL
Participating Laboratories: LANL, SNL

Mission Activity Description

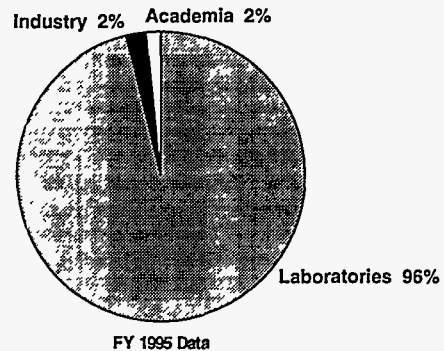
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Recent high-level technical reviews by the National Academy of Sciences and the Inertial Confinement Fusion Advisory Committee strongly support the role of the National Ignition Facility (NIF) as "the most scientifically valuable of the programs proposed for Science-Based Stockpile Stewardship." The NIF will duplicate experimental conditions that approach those found in a weapon secondary package during detonation. In the past, these conditions were attainable only through underground testing. Activities in this category include conceptual and advanced conceptual design, environmental documentation, vendor facilitization and pilot production, start-up, operational readiness reviews, and technical support as reflected in the NIF construction data sheet. The most immediate application of the NIF, once construction is complete, will be the gathering of data on high-energy-density phenomena that are relevant to similar phenomena associated with nuclear weapons. The NIF will also provide an important capability for weapon effects simulations.

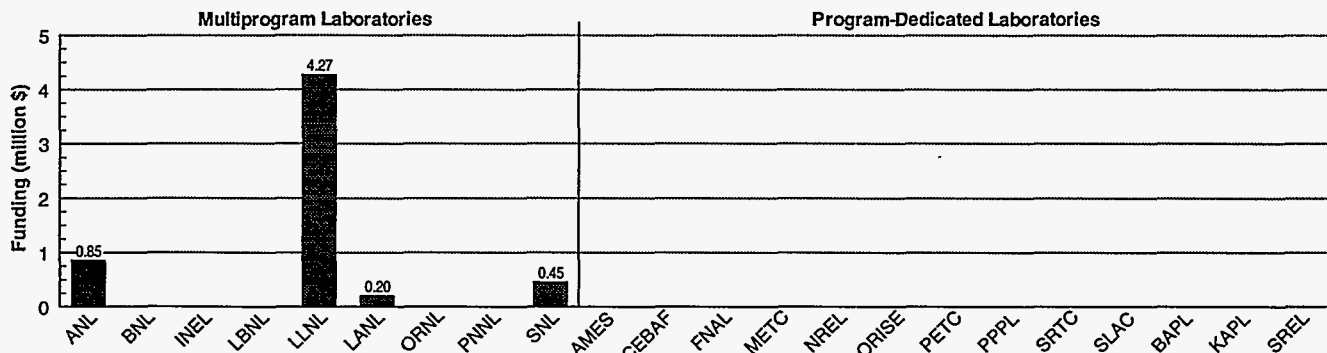
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Technology Transfer

Department of Energy Program

Program: Defense Programs
Office: Research and Development
Element: Technology Transfer
B&R Code: GB0106

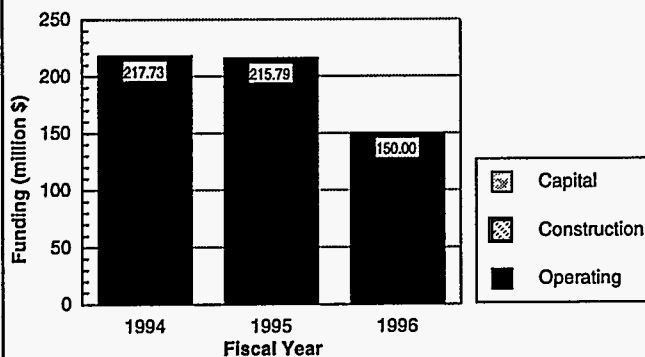
Laboratory Complex

Principal Laboratories: SNL, LANL, LLNL
Contributing Laboratories: ORNL
Participating Laboratories: ANL, INEL

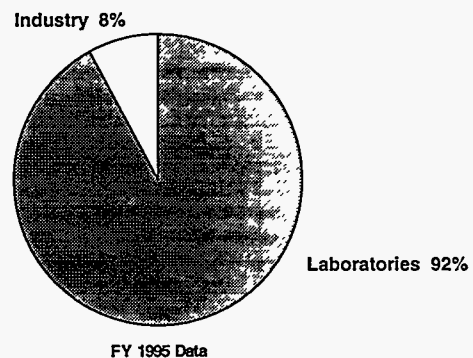
Mission Activity Description

The private sector and the Department of Energy share many of the same research and technology interests. Additionally, the private sector is an integral part of the weapons program as a supplier of many weapons components. The Technology Transfer activity supports the mission of the Department of Energy's Defense Programs (DP) by performing joint research between industry and the National Laboratories that best utilizes the strengths of each. These synergistic agreements allow the Department to cost-effectively work on issues of interest to DP, particularly those that support the weapons program, while simultaneously benefiting American industry. Some of the major areas being supported include: Agile Manufacturing, National Information Infrastructure, Machine Tool Program, High Performance Computing Program, and Integrated Circuit Fabrication and Packaging. Within each of these areas, one or more of the laboratories with a mission requirement in that area have ongoing projects with industry. Due to the tremendous number of projects, they cannot all be listed; some examples are the following: (1) the use of supercomputers to analyze a residual oil hydroprocessing unit including analysis of multiphase, turbulent, interpenetrating flows to increase understanding of their behavior in both chemical reactors and in weapon physics; (2) the Technologies Enabling Agile Manufacturing (TEAM) effort to enable U.S. industry to manufacture high-quality replacement parts for the weapons program with a minimum of costly certification; and (3) the development of accurate computer simulation of machining processes to benefit the industrial partner's metal-cutting techniques and the operations required for machining of plutonium, beryllium, and uranium components.

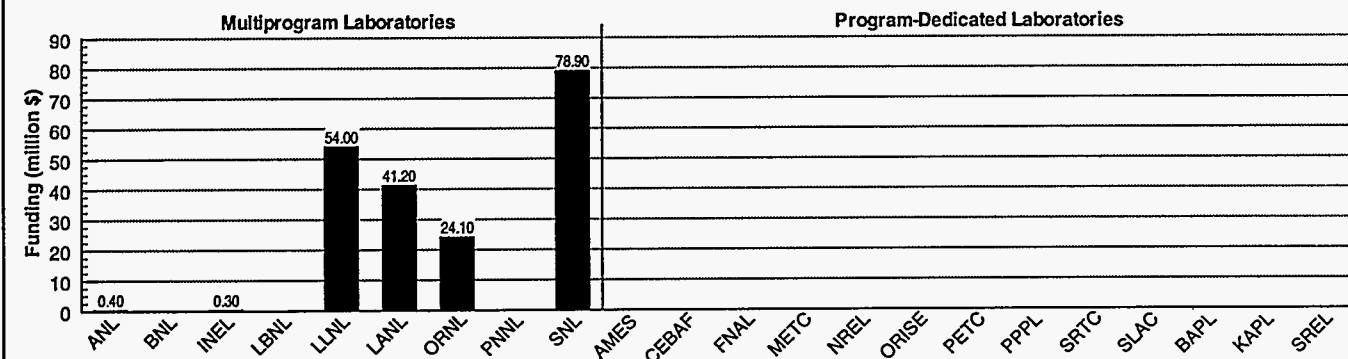
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



War Reserve New Production

Department of Energy Program

Program: Defense Programs
Office: Military Application and Stockpile Management
Element: War Reserve New Production
B&R Code: GB031001

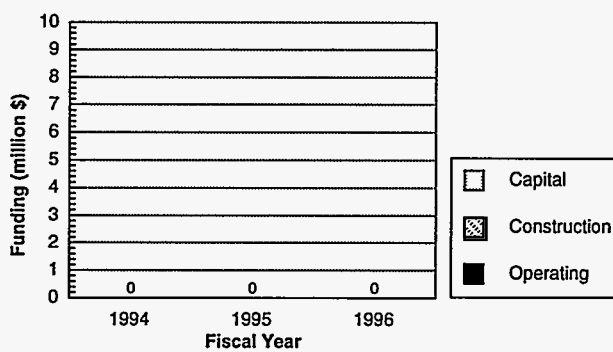
Laboratory Complex

Principal Laboratories: None
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

Even though the United States has halted production of new nuclear weapons and is reducing the size of its existing nuclear weapons stockpile, it still needs to retain the capability to produce weapons components. The newly manufactured weapons parts will be needed in the enduring stockpile to replace those that are destroyed during stockpile evaluation tests. War Reserve new production also includes activities to procure, fabricate, stage, and assemble materials, piece parts, and components that will be used to fulfill Presidential Decision Directive requirements for completed War Reserve weapons stockpile items.

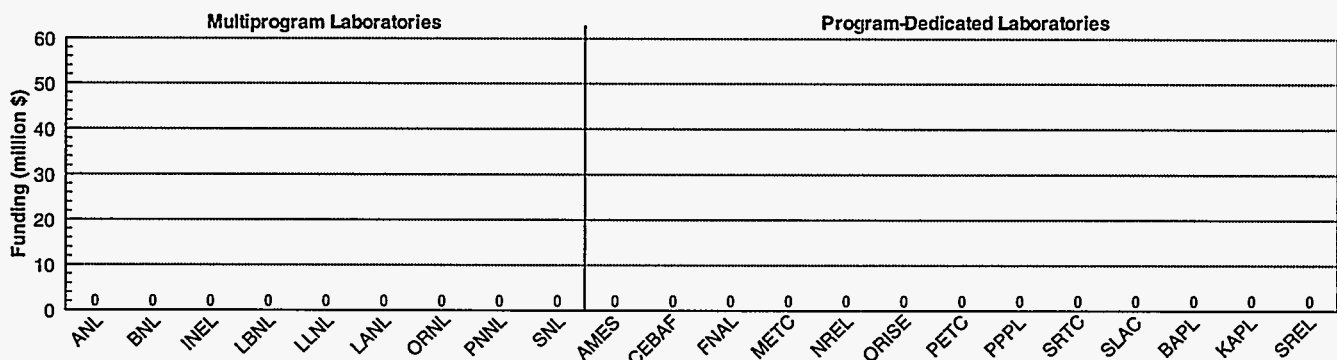
Funding History



Laboratory-Academia-Industry Participation

No current distribution available

Fiscal Year 1995 Funding Profile



Weapons Program

Department of Energy Program

Program: Defense Programs
Office: Military Application and Stockpile Management
Element: Stockpile Management
B&R Code: GB031002

Laboratory Complex

Principal Laboratories: SNL
Contributing Laboratories: LANL, LLNL
Participating Laboratories: None

Mission Activity Description

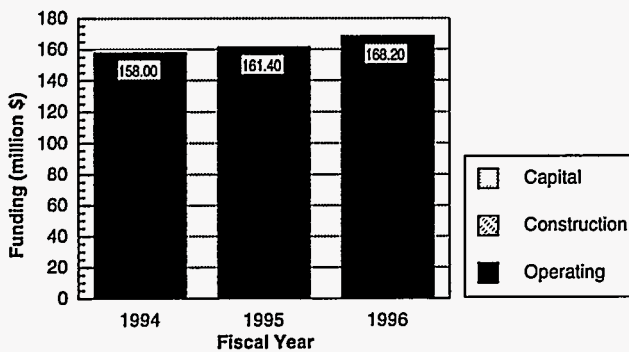
The U.S. nuclear deterrent forms a cornerstone of national security policy. DOE is responsible for keeping the U.S. nuclear weapons stockpile safe and reliable. The Weapons Program includes the direct activities at the Defense Programs laboratories and production facilities necessary to meet all directive schedules for Stockpile Maintenance, Stockpile Evaluation, and Dismantlement. It does not include research and development work performed in these areas. That work is supported by Stockpile Stewardship funds.

Stockpile Maintenance efforts keep the nuclear weapons in the enduring stockpile at the highest level of safety and security. Activities include limited life component exchange, maintenance, scheduled modifications and repairs, staging of materials awaiting processing, retrofit activities, and unscheduled weapon systems support for the enduring stockpile.

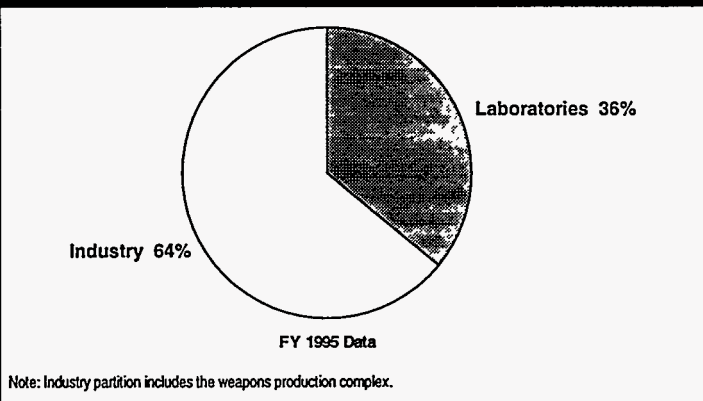
Stockpile Evaluation activities assess the quality of nuclear weapons and components in the enduring war reserve stockpile and the products delivered to the stockpile. A rigorous reliability assessment program is required to continually evaluate and determine that nuclear weapons in the stockpile are maintained according to design specifications. Evaluation concerns the understanding of quality, reliability, surety, and revalidation of weapons and components in the existing stockpile. Activities include new material laboratory tests, new material flight tests, stockpile laboratory tests, stockpile flight tests, quality evaluations, special testing, technical services, and all surveillance testing (that is, shelf-life programs, detonator samples, accelerated core, and historical sampling).

Dismantlement includes activities for weapons associated with retirement, disassembly, component characterization, and disposal and reclamation of materials and components; the engineering, development, testing, certification, procurement, and refurbishment of containers required for interim storage; and the staging and storage of weapons, components, and materials awaiting dismantlement.

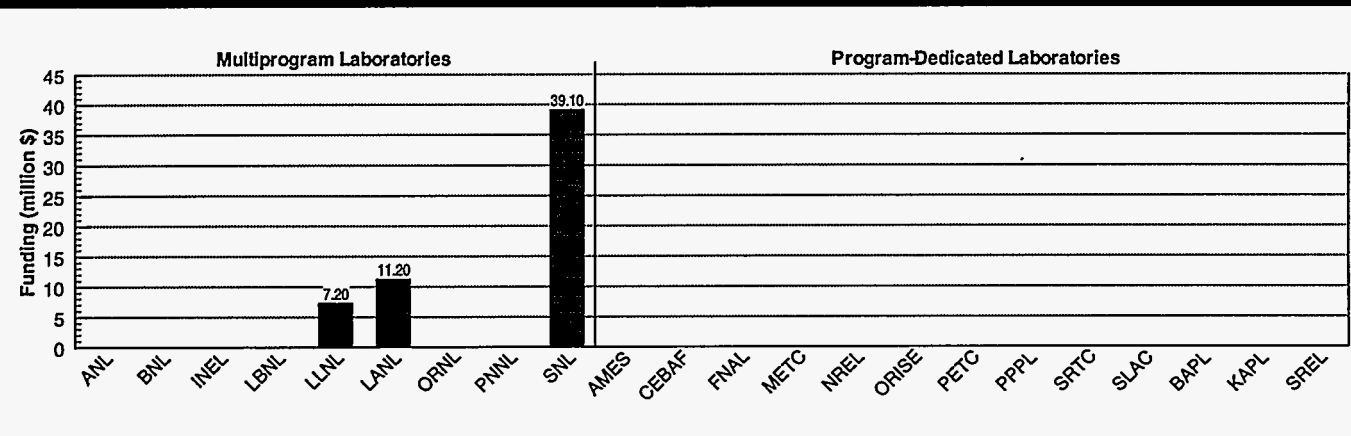
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Materials Recycle and Recovery

Department of Energy Program

Program: Defense Programs
Office: Military Application and Stockpile Management
Element: Stockpile Management
B&R Code: GB031005

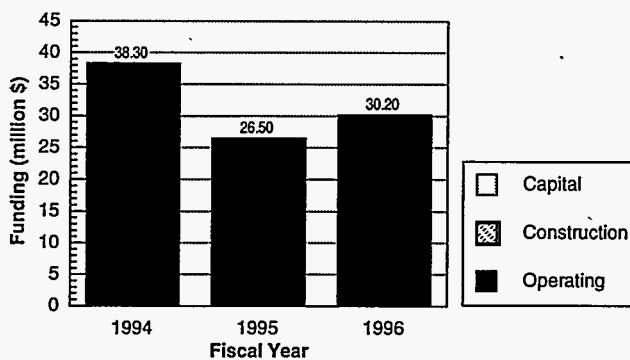
Laboratory Complex

Principal Laboratories: LANL, LLNL
Contributing Laboratories: None
Participating Laboratories: None

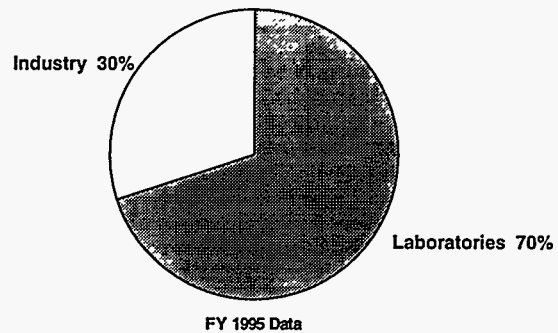
Mission Activity Description

Possessing a credible nuclear deterrent is a vital part of the U.S. national security strategy. The Department of Energy is responsible for ensuring the safety and security of the nuclear weapons stockpile. As a consequence of weapons production, maintenance, assessment, dismantlement, and disposal operations, material is produced that must be returned to the system. Activities associated with the Materials Recycle and Recovery activity include recycle and recovery of plutonium, enriched uranium, and tritium from fabrication and assembly operations, limited life components, and dismantlement of weapons and components. It also involves the process of recycling and purifying the above materials to meet specifications for safe, secure, and environmentally acceptable storage. In addition, this program includes development and implementation of new plutonium and uranium processes or improvements to existing processes for fabrication and recovery operations, and for material stabilization, conversion, and storage. These activities are largely conducted at two of the production sites, namely Savannah River, and Y-12, with some additional work occurring at Los Alamos National Laboratory.

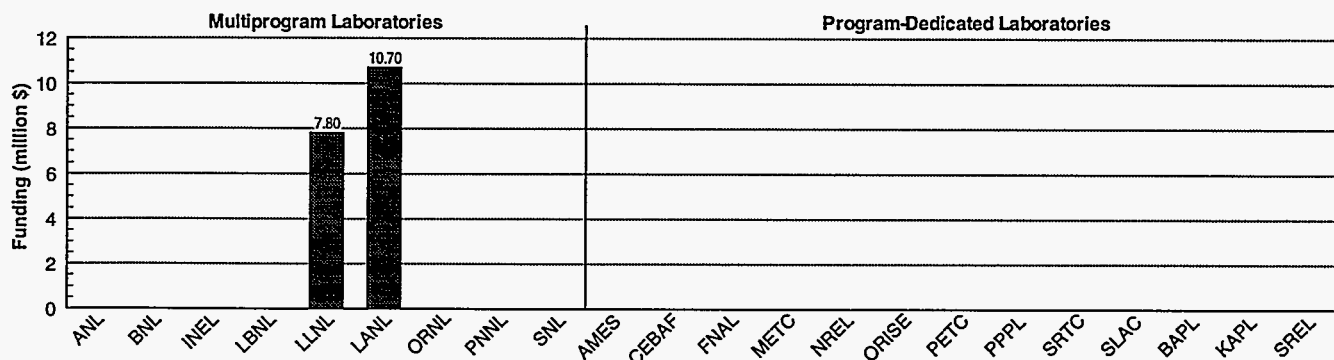
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Production Capability Assurance

Department of Energy Program

Program: Defense Programs
Office: Military Application and Stockpile Management
Element: Stockpile Management
B&R Code: GB031301

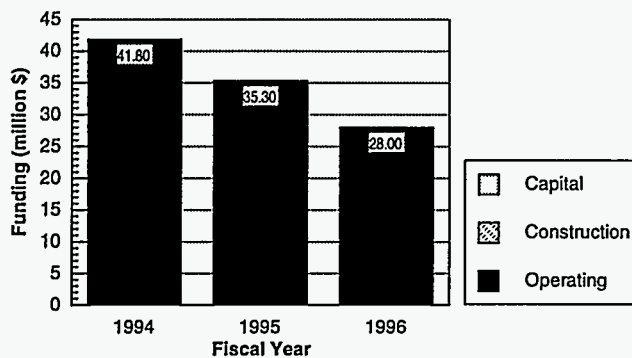
Laboratory Complex

Principal Laboratories: None
Contributing Laboratories: None
Participating Laboratories: None

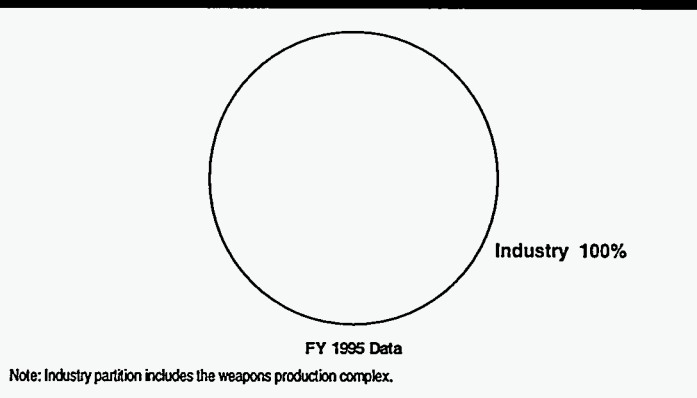
Mission Activity Description

Although the United States is no longer manufacturing new nuclear weapons, the Department of Energy still has a requirement to maintain the capability to manufacture new weapons as well as maintain a capability to "ramp up" to higher production rates if required. A basic capability to manufacture weapons to replace those removed from the enduring stockpile is required. The Production Capability Assurance activity is designed to maintain long-term competence in key manufacturing technologies and processes that are needed to ensure the viability of the enduring stockpile. This includes rebuilding enduring stockpile components, as well as developing and demonstrating components, subassemblies, and assemblies that could be used to upgrade the safety, security, and reliability of the enduring stockpile. Efforts are focused on maintaining a viable nuclear capability in the absence of explicit Department of Defense requirements for the production or retrofit of nuclear weapons. This activity supports development efforts to facilitate standardization, implementation of modern principles in design and manufacturing, process improvements, and materials capabilities to improve the baseline production and surveillance processes. Also, support is provided to technology development activities to eliminate or minimize waste generation and workplace hazards anticipated from performance of assigned missions. Some activities associated with this program are the following: (1) advanced manufacturing and plant operations support for robotics; (2) maintaining assurance of capability in beryllium technologies; (3) special cleaning, forming simulation, friction welding of dissimilar metals; (4) maintaining detonator and detonator powder manufacturing capabilities; and (5) optically initiated actuator design and manufacturing.

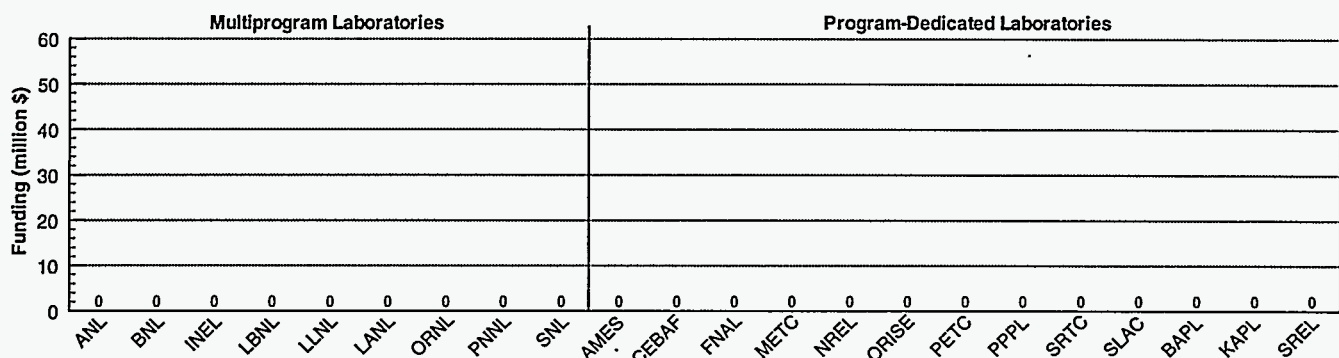
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Nuclear Emergency Search Team

Department of Energy Program

Program: Defense Programs
Office: Military Application and Stockpile Support
Element: Emergency Response
B&R Code: GB010305

Laboratory Complex

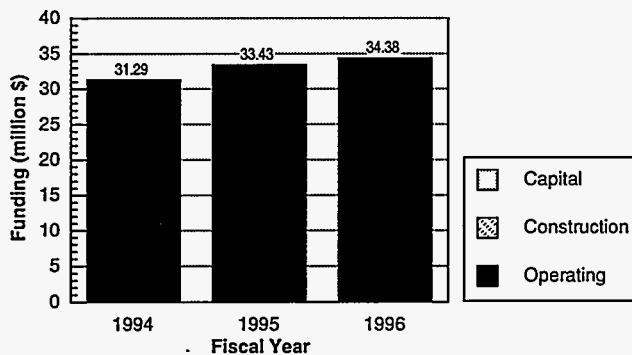
Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

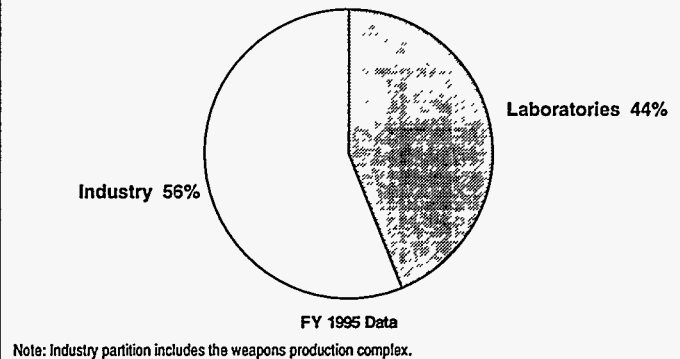
The United States requires the capability to deal with nuclear accidents and nuclear incidents worldwide. The Department of Energy, due to its expertise in managing the nuclear weapons stockpile, possesses the knowledge and national technical capabilities necessary to deal with such contingencies. The Department of Energy's major radiological Emergency Response assets and capabilities are consolidated under the Deputy Assistant Secretary for Military Application and Stockpile Support, which provides overall program management and the organizational structure during both emergency and non-emergency conditions for the personnel, equipment, and activities that collectively compose the program.

The Nuclear Emergency Search Team (NEST) consists of engineers, scientists, and other technical specialists from DOE's national laboratories and other contractors who support the nuclear weapons complex. NEST is prepared to respond within 4 hours of notification with specially trained teams and specialized equipment to assist the FBI in addressing nuclear or radiological threats. Deployable NEST assets include intelligence, communications, search, assessment, access, diagnostics, disablement, operations, containment/damage limitations, logistics, and health physics capabilities. A significant size cadre (approximately 200) of trained search personnel and specialized radiation detection systems are available to search for ionizing radiation-producing materials and are part of the NEST capability.

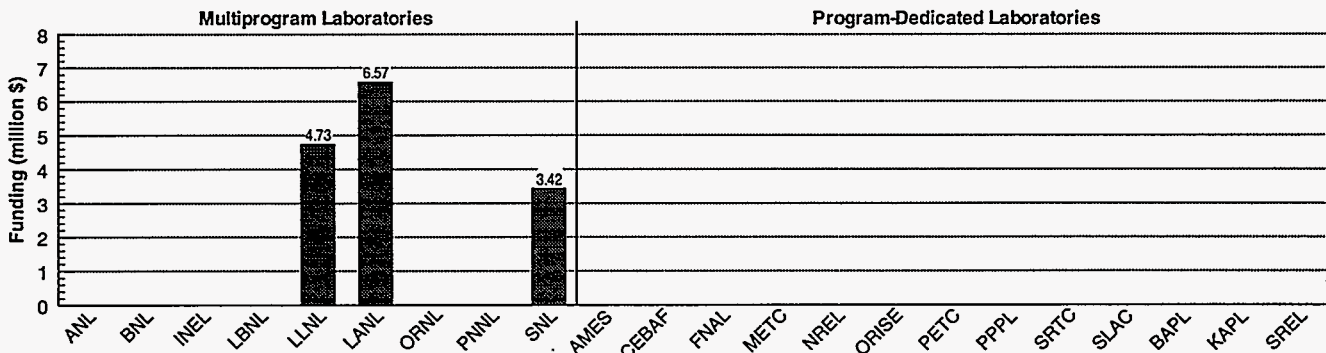
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Accident Response Group

Department of Energy Program

Program: Defense Programs
Office: Military Application and Stockpile Support
Element: Emergency Response
B&R Code: GB010307

Laboratory Complex

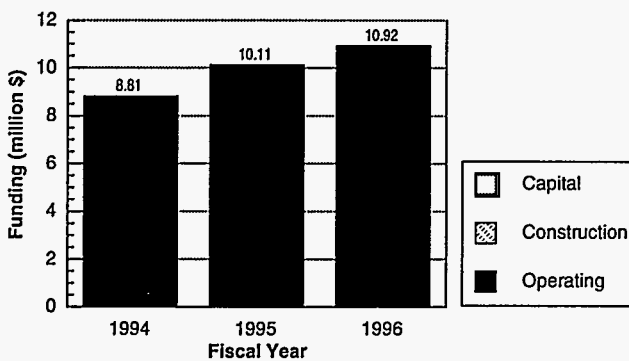
Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

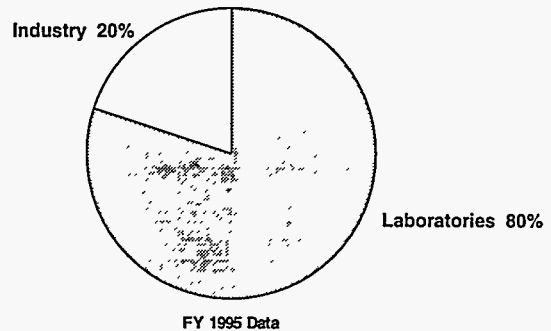
The United States requires the capability to deal with nuclear accidents and nuclear incidents worldwide. The Department of Energy, due to its expertise in managing the nuclear weapons stockpile, possesses the knowledge and national technical capabilities necessary to deal with such contingencies. The Department of Energy's seven major radiological Emergency Response assets and capabilities are consolidated under the Deputy Assistant Secretary for Military Application and Stockpile Support, which provides overall program management and the organizational structure during both emergency and nonemergency conditions for the personnel, equipment, and activities that collectively compose the program.

The Accident Response Group (ARG) is composed of a cadre of weapons designers and engineers, physical scientists, and other technical specialists from DOE's weapon complex, together with specially designed equipment that can collectively or independently be deployed by the Department to provide timely assistance to peacetime accidents and significant incidents involving nuclear weapons throughout the world. ARG-deployable capabilities include weapon diagnostics (radiography); robotics; liquid abrasive cutters; anticontamination clothing and respirators; personnel decontamination stations (showers/hotline operations); ground/soil contamination survey monitors and equipment; air, soil, and water analysis equipment; weapon packaging and containment equipment; and ground transportation for damaged weapons. ARG assumes onsite management of security at the scene of nuclear weapons incidents if the materials are in DOE custody when an incident occurs. ARG also provides technical advice for determining the radioactive hazards; assists in the collection, identification, and disposition of contaminated materials; and advises on the type of additional DOE resources that may be required. Onsite ARG direction is provided by a designated DOE senior official who, in coordination with the Program Office, is appointed by the DOE Albuquerque Operations Office. Equipment and personnel are based in several locations including Albuquerque, New Mexico; Las Vegas, Nevada; Amarillo, Texas; Livermore, California; and Los Alamos, New Mexico.

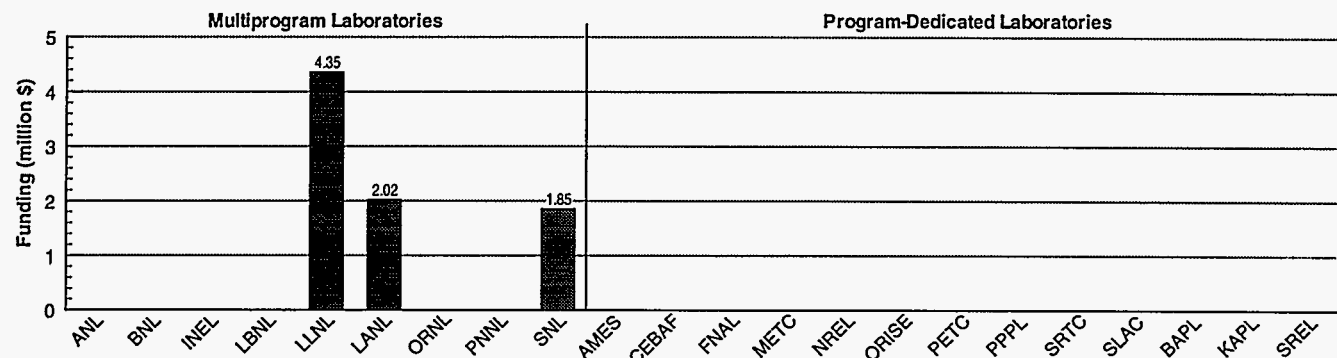
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Atmospheric Release Advisory Capability

Department of Energy Program

Program: Defense Programs
Office: Military Application and Stockpile Support
Element: Emergency Response
B&R Code: GB010308

Laboratory Complex

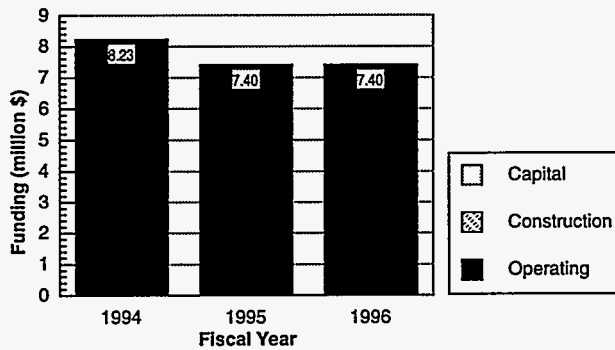
Principal Laboratories: LLNL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

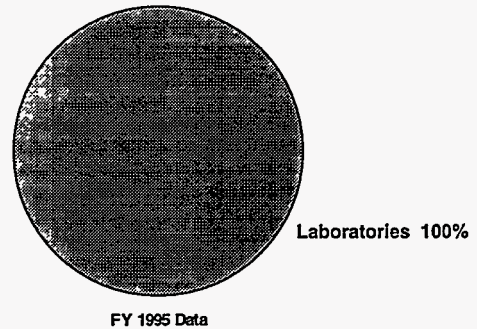
The United States requires the capability to deal with nuclear accidents and nuclear incidents worldwide. The Department of Energy, due to its expertise in managing the nuclear weapons stockpile, possesses the knowledge and national technical capabilities necessary to deal with such contingencies. The Department of Energy's major radiological Emergency Response assets and capabilities are consolidated under the Deputy Assistant Secretary for Military Application and Stockpile Support, which provides overall program management and the organizational structure during both emergency and nonemergency conditions for the personnel, equipment, and activities that collectively compose the program.

The Atmospheric Release Advisory Capability (ARAC) is a computer-based, emergency preparedness and response predictive capability that was developed for the Department of Energy by LLNL. ARAC provides rapid predictions of the transport, diffusion, and deposition of radionuclides released to the atmosphere and dose projections to people and the environment. ARAC's predictive capability supports both planning and real-time events at DOE and Department of Defense (DOD) sites, and is prepared to respond to any radiological accident in which the Department has an interest. The ARAC Center is located at, and is operated by, LLNL, Livermore, California. There are additional site system terminals at selected DOE and DOD locations throughout the United States. The ARAC-generated dispersion charts/isopleths are valuable tools for planning and implementing protective actions in the event of a major radiological incident.

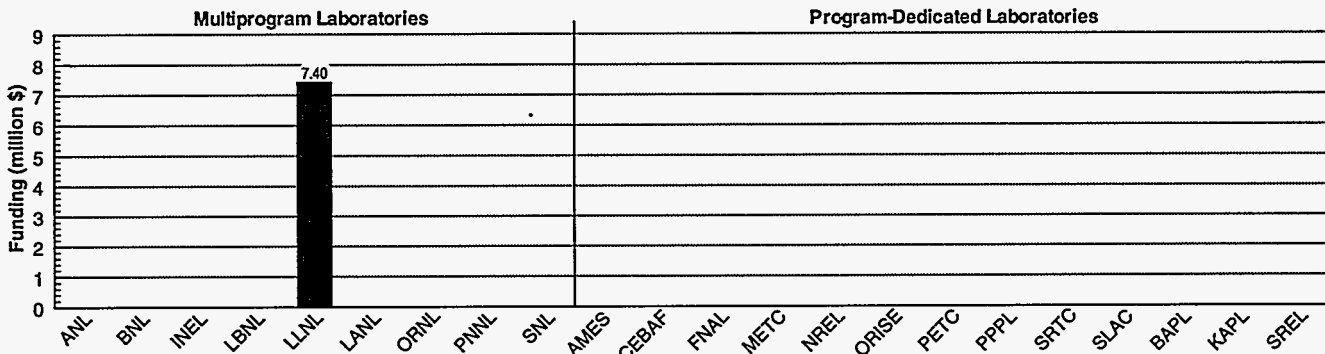
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Nuclear Weapons Complex Reconfiguration

Department of Energy Program

Program: Defense Programs
Office: Weapons Stockpile Management
Element: Nuclear Facilities
B&R Code: GB0602

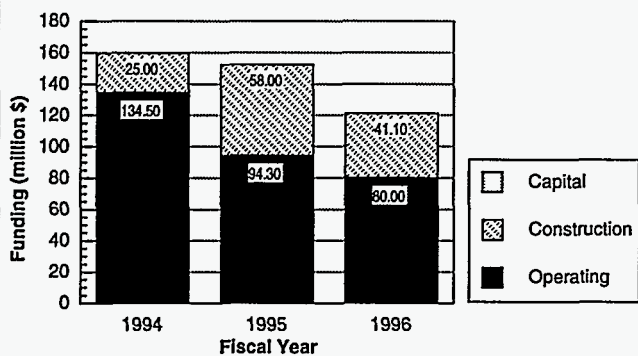
Laboratory Complex

Principal Laboratories: SNL
Contributing Laboratories: LANL
Participating Laboratories: LLNL

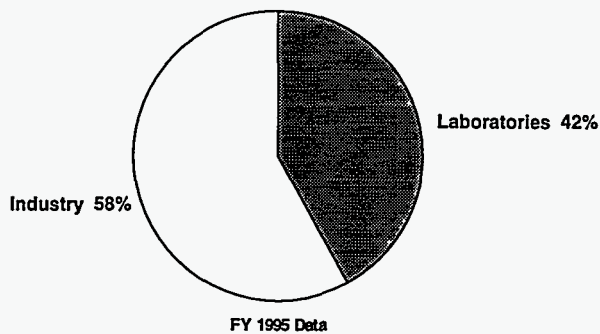
Mission Activity Description

In the past, the United States made a significant investment in facilities, equipment, and personnel to support its nuclear deterrent. Since the end of the Cold War, the United States has been reevaluating its defense structure to determine its proper size. A significant portion of the present nuclear weapons stockpile is no longer needed by the Department of Defense, and the large production rates of the past are no longer required. The Department of Energy, with responsibility for the Nation's nuclear stockpile, is downsizing its weapons complex in response to the reduced requirements. The Nuclear/Nonnuclear Facilities program supports the transfer and consolidation of the parts of the weapons complex to produce the smaller, more efficient complex needed for the future. The program covers the costs of making the transition as well as the qualification of the receiver sites in the transferred capabilities. Costs are covered in the nonnuclear area for capital improvements and activity transfers between sites, which include: technology and processes; transfer of inventories, conducting special studies, training, and certifying the workforces; conducting environmental safety studies; testing, evaluating, and transporting materials and components from one facility to another. For nuclear facilities, the program includes conceptual design and preoperational prove-in phases. Specific examples include the following: defining and developing manufacturing processes, transferring manufacturing processes and associated equipment, cleaning up existing facilities, transferring inventories and processing technologies to the selected site, conducting special studies, operating and maintaining the facilities through turnkey activities, hiring, transferring, training and certifying the workforce, project management, conducting environmental and safety studies, testing and evaluating, and transporting materials, parts, and components, from one facility to another. A programmatic environmental impact statement process is examining options for the Department to provide a more flexible and efficient production complex that can quickly respond to future needs.

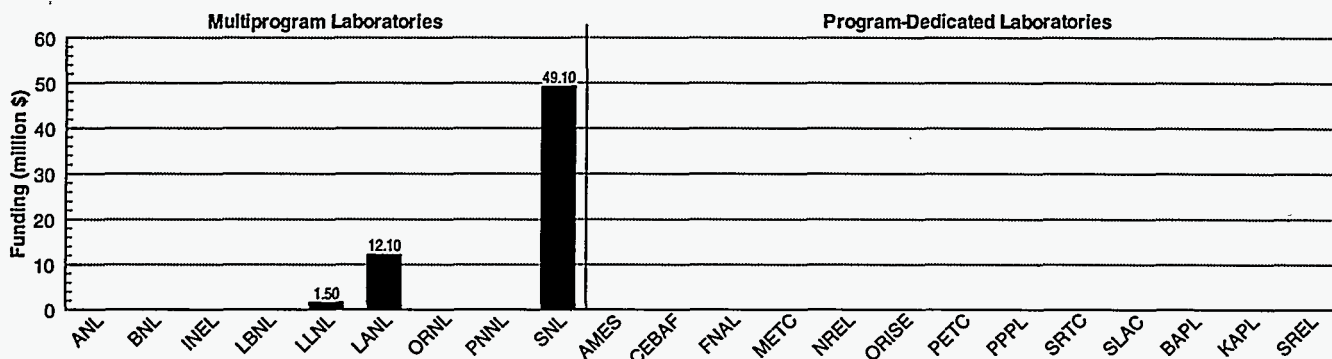
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Accelerator Production of Tritium

Department of Energy Program

Program: Defense Programs
Office: Tritium Project Office
Element: Accelerator Production of Tritium
B&R Code: Not available for FY95

Laboratory Complex

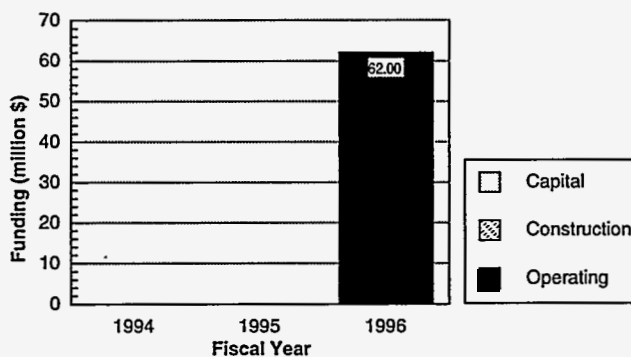
Principal Laboratories: LANL
Contributing Laboratories: None
Participating Laboratories: BNL, LLNL, SNL

Mission Activity Description

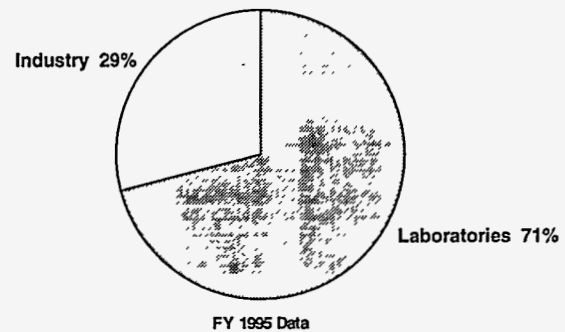
Modern nuclear weapons use tritium, a radioactive isotope of hydrogen to enhance their yield. To maintain the nuclear weapons stockpile, as directed by the President in the Nuclear Weapon Stockpile Memorandum, the United States requires a reliable source of the isotope. Because tritium has a relatively short radioactive half life of 12.3 years, it must be replenished periodically. No tritium has been produced in the United States since 1988. DOE is currently recycling tritium from retired weapons to meet the stockpile requirements for tritium. However, recycling can only meet tritium demands for a limited time; current projections indicate a START-II-sized U.S. nuclear weapons stockpile will require a new tritium source in approximately 2011. Larger stockpiles, consistent with START I and the 1996-2001 Nuclear Weapon Stockpile Memorandum, approved by both DOE and the Department of Defense and forwarded to the President, will require a new tritium source in approximately 2005.

The Accelerator Production of Tritium (APT) is one of two production options, which is capable of producing the necessary quantity of tritium. Because the APT is a nonreactor technology, it is believed this technology option will encounter fewer siting, construction, and operational challenges than would a new reactor facility. Los Alamos National Laboratory is leading a multiple laboratory and site effort to demonstrate that the application of accelerator and spallation target technology can provide a reliable source of tritium that can be operated within acceptable scheduling and budgetary constraints. The APT accelerator would be much more powerful (130 megawatts) than the largest such linear accelerator in the complex (LANSCE at Los Alamos), so an engineering development and demonstration program has been recommended by Los Alamos and the other DOE laboratories supporting the effort, namely Brookhaven, Livermore, and Sandia. The accelerator option, if chosen, would be constructed at DOE's Savannah River Site, located near Aiken, SC.

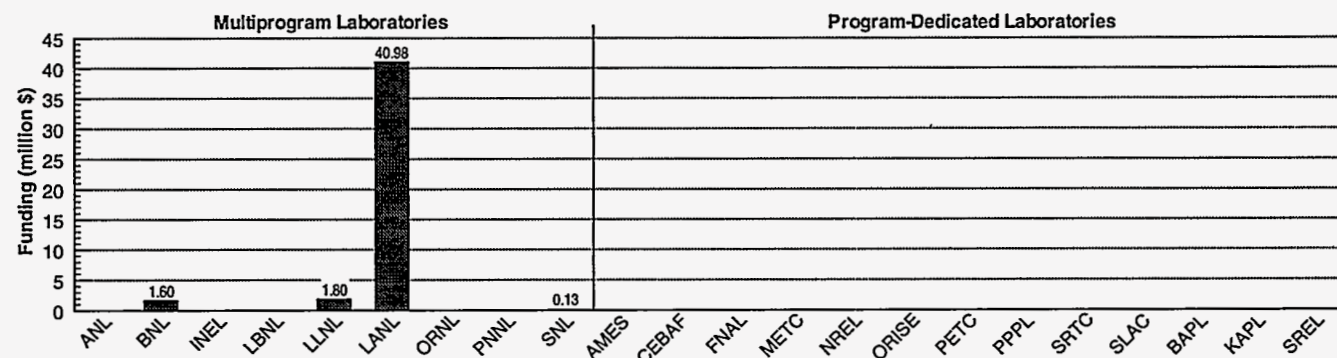
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1996 Funding Profile



Note: Funding profile for fiscal year 1996 is shown.

Alternative Tritium Production Technologies

Department of Energy Program

Program: Defense Programs
Office: Tritium Project Office
Element: Accelerator Production of Tritium
B&R Code: Not available for FY95

Laboratory Complex

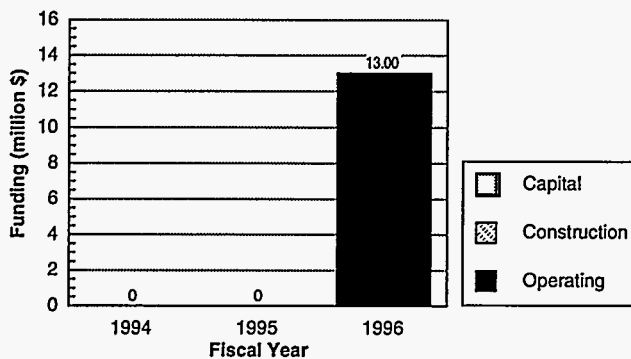
Principal Laboratories: INEL, PNNL
Contributing Laboratories: None
Participating Laboratories: BNL, SNL

Mission Activity Description

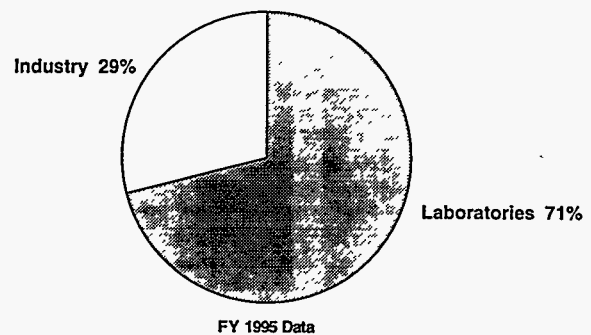
Modern nuclear weapons use tritium, a radioactive isotope of hydrogen to enhance their yield. To maintain the nuclear weapons stockpile, as directed by the President in the Nuclear Weapon Stockpile Memorandum, the United States requires a reliable source of the isotope. Because tritium has a relatively short radioactive half life of 12.3 years, it must be replenished periodically. No tritium has been produced in the United States since 1988. DOE is currently recycling tritium from retired weapons to meet the stockpile requirements for tritium. However, recycling can only meet tritium demands for a limited time; current projections indicate a START-II-sized U.S. nuclear weapons stockpile will require a new tritium source in approximately 2011. Larger stockpiles, consistent with START I and the 1996-2001 Nuclear Weapon Stockpile Memorandum, approved by both DOE and the Department of Defense and forwarded to the President, will require a new tritium source in approximately 2005.

As part of a dual track approach to meeting future tritium needs, DOE is examining accelerator production of tritium and tritium production in nuclear reactors. Using nuclear reactors to irradiate targets from which tritium can be extracted is the technique utilized in the past. The major thrust of the program at present is in target design. The program to develop new targets from which tritium can be extracted is composed of several phases: target design, development, and testing; target qualification; target fabrication and extraction; and production engineering. Each phase will be conducted at one or more labs or plants depending on the capabilities possessed by each.

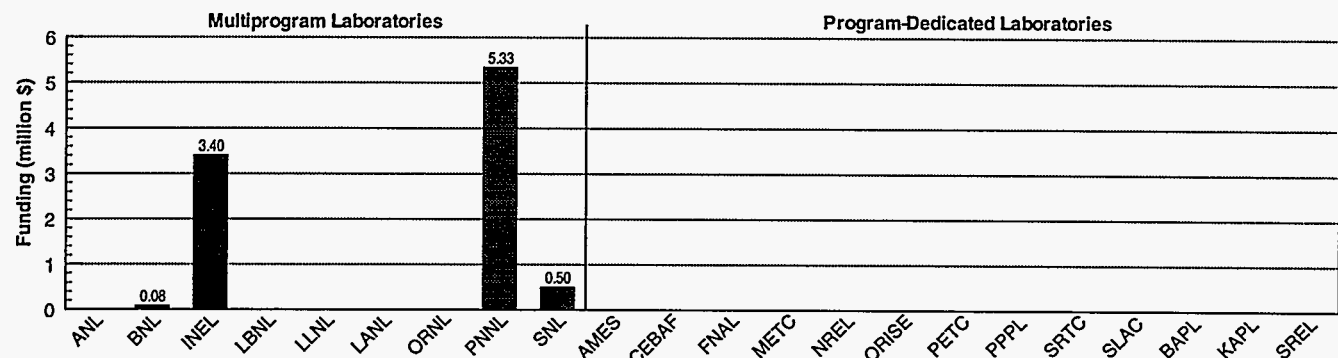
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1996 Funding Profile



Note: Funding profile for fiscal year 1996 is shown.

Nuclear Materials Surveillance

Department of Energy Program

Program: Defense Programs
Office: Military Application and Stockpile Maintenance
Element: Stockpile Management
B&R Code: GE

Laboratory Complex

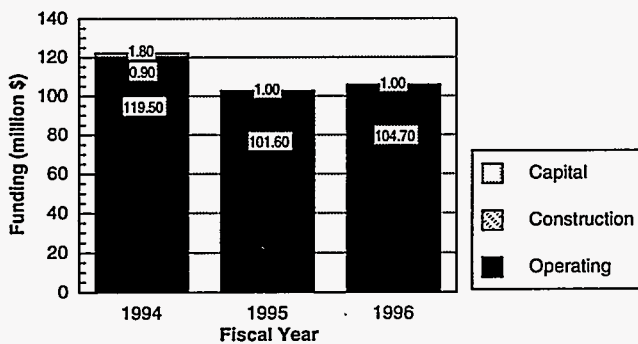
Principal Laboratories: LANL, ORNL
Contributing Laboratories: BNL
Participating Laboratories: ANL, LLNL, ORISE, SNL

Mission Activity Description

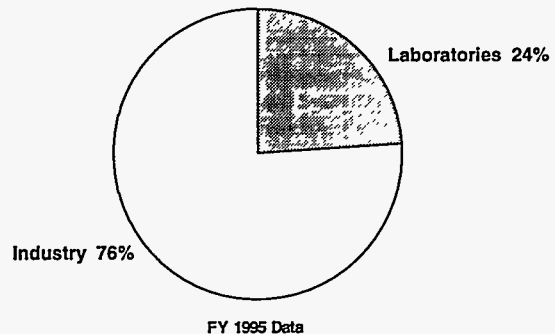
The Department of Energy is responsible for ensuring the safety and security of the Nation's special nuclear materials and its nuclear weapons. As the weapons complex is downsized, facilities and material may be deemed excess to the needs of the enduring stockpile. The Nuclear Materials Surveillance activity funds the storage, handling, shipping, safeguarding, control and accountability, and disposition for Defense Programs nuclear materials located at Defense Programs' facilities and former Defense Programs' facilities that have been transferred to Environmental Management at the Fernald, Hanford, Idaho, and Savannah River sites. This program supports the Defense Programs safety, safeguards, and security oversight activities that include policy guidance, review and evaluation of existing programs, compliance with regulations, and the review of ongoing program cost-effectiveness.

Programmatic activities include the following: safety analysis and evaluation reports; design report rules, guidance and standards; risk-based prioritization methods; mentoring support; accident consequence methods; operational readiness reviews; training support and assistance; technical support for maintenance and safeguards and security of Defense Programs facilities; operation of Building 9206 at Y-12 Plant until phaseout and transfer to Building 9212; decontamination and refinement of surplus precious metals; operation of U-233 Storage and Distribution Center; coordination with U.S. Enrichment Corporation for sale of excess low enriched uranium; safeguards and security protection for Defense Programs-owned special nuclear materials (SNM) at Hanford, Fernald, Idaho, and Savannah River; and the Special Projects Program.

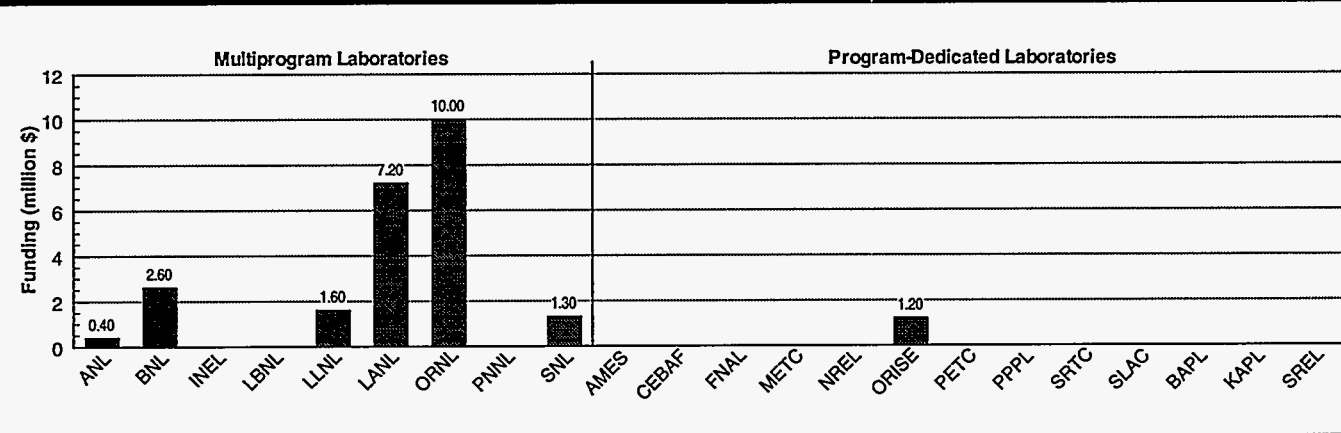
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Onsite Systems

Department of Energy Program

Program: Nonproliferation and National Security
Office: Research and Development
Element: Onsite Systems
B&R Code: GC0401

Laboratory Complex

Principal Laboratory: LLNL, SNL
Contributing Laboratories: LANL, ORNL, PNNL
Participating Laboratories: ANL, BNL, INEL

Mission Activity Description

The Onsite Systems Program's activities focus on the development and demonstration of prototypes of detection technology and analytical methods to support on a timely basis both current and future U.S. Government policies and initiatives on arms control and nonproliferation. The program focuses on cooperative transparency and confidence-building measures that use both portable and unattended instrumentation with real-time analysis and data display capabilities. The priorities of the program are driven by longstanding and current policies from the intelligence and arms control communities.

Radiation Detection Technologies—This core research technology development activity advances the state of the art in radiation sensor materials.

Warhead Dismantlement and Transparency—Advanced technical means are developed to verify accountability and chain of custody of nuclear weapons.

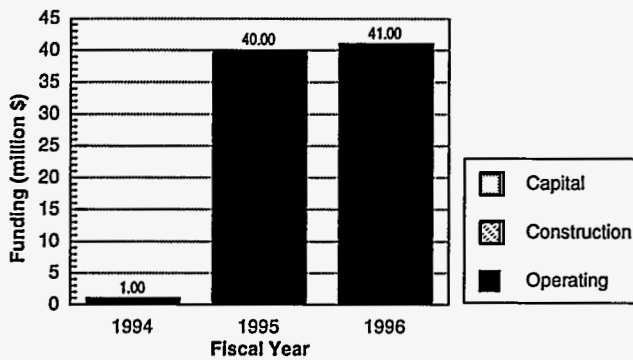
Special Nuclear Material Accountability—Advanced technical means are developed to verify accountability and chain of custody of special nuclear material.

Underground Structure Detection—Onsite geophysical measurements research provides a key technical base to support interagency requirements to detect and characterize subsurface targets related to the acquisition, production, and maintenance of weapons of mass destruction.

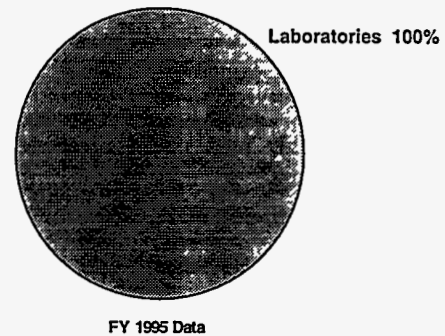
Cooperative Monitoring—Cooperative monitoring results in the development of unattended or hand-held detection technologies and systems to support U.S. Government initiatives, treaties and agreements for control of weapons of mass destruction.

Airborne Multisensor Pod System—The Airborne Multisensor Pod System (AMPS) program provides a multisensor data collection platform that will be used to test and evaluate data fusion concepts.

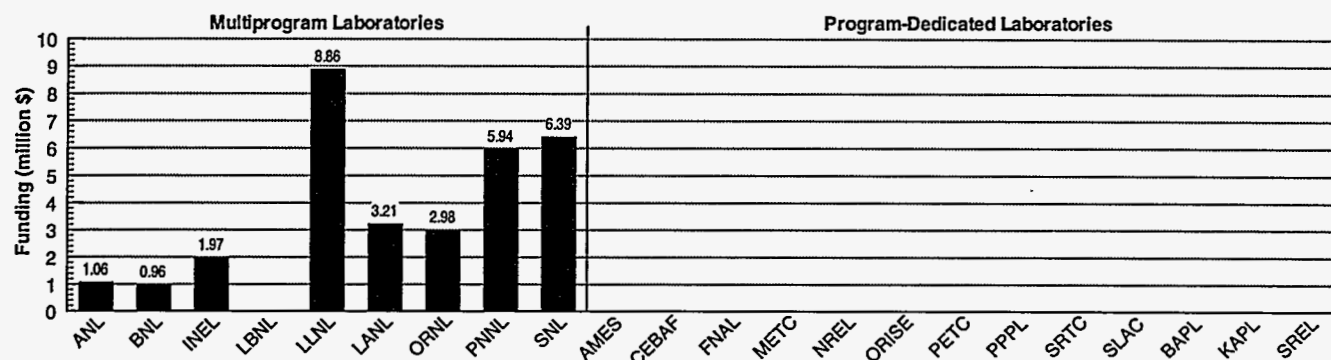
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Regional Monitoring Systems

Department of Energy Program

Program: Nonproliferation and National Security
Office: Research and Development
Element: Regional Monitoring Systems
B&R Code: GC0402

Laboratory Complex

Principal Laboratories: LANL, LLNL
Contributing Laboratories: PNNL, SNL
Participating Laboratories: ANL, INEL, ORNL

Mission Activity Description

Regional monitoring activities focus on technology development in support of the detection, location, and characterization of nuclear proliferation activities. The technology research has two thrusts: (1) identification of suspect activity through the use of effluents to fingerprint nuclear weapon production activities, and (2) comprehensive test ban verification, where subsurface data can be integrated with other technology data to detect and identify testing activities.

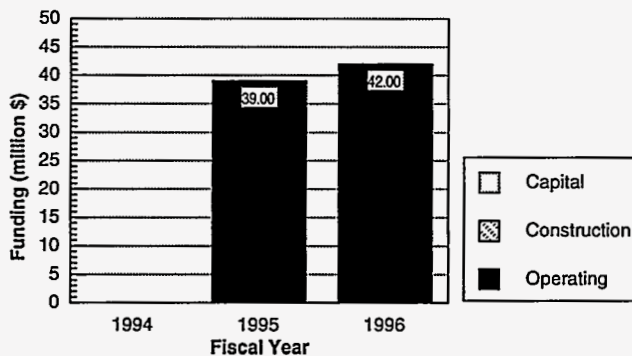
Effluent Detection and Analysis

Effluent detection and analysis technology is being developed to find and analyze chemical signatures indicative of nuclear weapons proliferation and production. Efforts to identify effluent analysis methods and technology potentially applicable to the monitoring of a comprehensive nuclear weapons test ban are being given the highest priority. This effort includes the development of real-time in-situ methods and instrumentation for regional environmental radionuclide monitoring networks and advanced ultrasensitive laboratory instrumentation for chemical isotopic analysis.

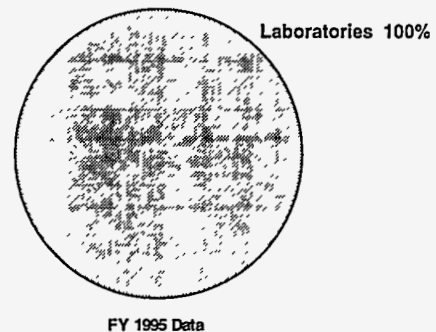
Comprehensive Test Ban Treaty Research and Development

The subsurface monitoring research and development program has been redirected to absorb the seismic research and development activities formerly performed by the Advanced Research Projects Agency. The objective is to provide U.S. Government agencies responsible for monitoring or verifying compliance with a future Comprehensive Test Ban Treaty with technologies, algorithms, hardware, and software for integrated systems to detect, locate, and characterize subsurface nuclear explosions at the thresholds and confidence levels that meet U.S. requirements in a cost-effective manner. Research is focused on methods and systems development to effect discrimination between nuclear detonations, earthquakes, and large chemical explosions at relatively low levels. The subsurface monitoring program is organized according to five areas: seismic monitoring, ocean monitoring, infrasound, onsite inspection, and automated data processing.

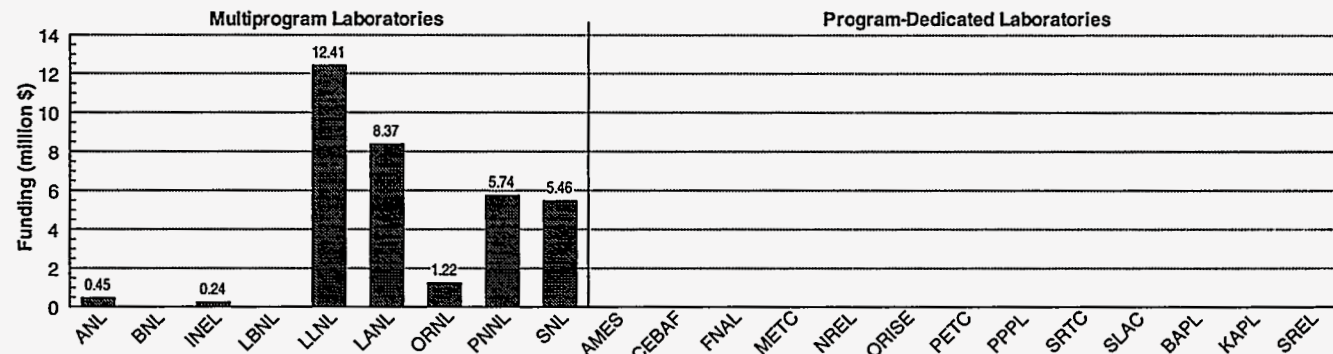
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Remote Sensing Systems

Department of Energy Program

Program: Nonproliferation and National Security
Office: Research and Development
Element: Remote Sensing Systems
B&R Code: GC0403

Laboratory Complex

Principal Laboratories: LANL, SNL
Contributing Laboratories: None
Participating Laboratories: INEL, LLNL

Mission Activity Description

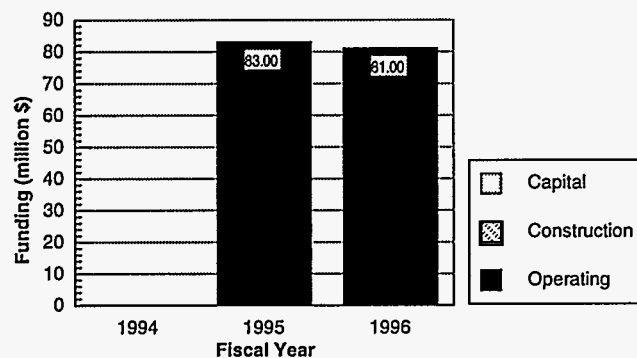
Remote sensing activities result in the development of special sensors for deployment on satellite platforms for nuclear explosion detection and proliferation detection. The base technology and infrastructure program develops new satellite technologies and evaluates new sensor concepts. It also provides capabilities for automated design definition, fabrication oversight, environmental testing, component traceability, and as needed, failure analysis and flight-quality repair of DOE instrumentation systems for satellite applications.

Nuclear explosion detection technology results in the implementation of operational payloads meeting national monitoring requirements for detecting nuclear explosions in the atmosphere and in near-Earth space. This program has three primary objectives: verification of the Limited Test Ban Treaty (and eventually a comprehensive test ban treaty), monitoring related to nuclear testing and the Nuclear Nonproliferation Treaty, and strategic battle management in the event of nuclear war (funding for this third objective is provided by the Air Force).

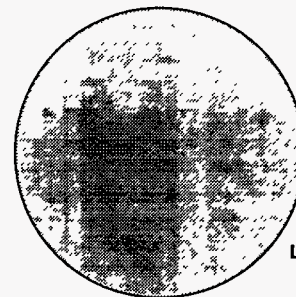
Sensors and systems deployed for these purposes will be of fundamental importance to the monitoring of a worldwide comprehensive nuclear test ban. Operational systems currently profile continuous worldwide surveillance from the Global Positioning System and other military platforms. Ninety-nine satellite and space probe payloads have been launched during the 35 years of this program.

The proliferation detection technology program represents a broadening in scope in support of U.S. Government concerns and initiatives regarding the proliferation of weapons of mass destruction. This is an advanced technology development effort dedicated to proof-of-concepts and demonstrations of new technology and capabilities applicable to nuclear proliferation activities prior to device detonations, as well as to the remote detection of other clandestine activities having military significance. This program also provides a test-bed for intelligence- and environment-related multiple-use remote sensor systems.

Funding History



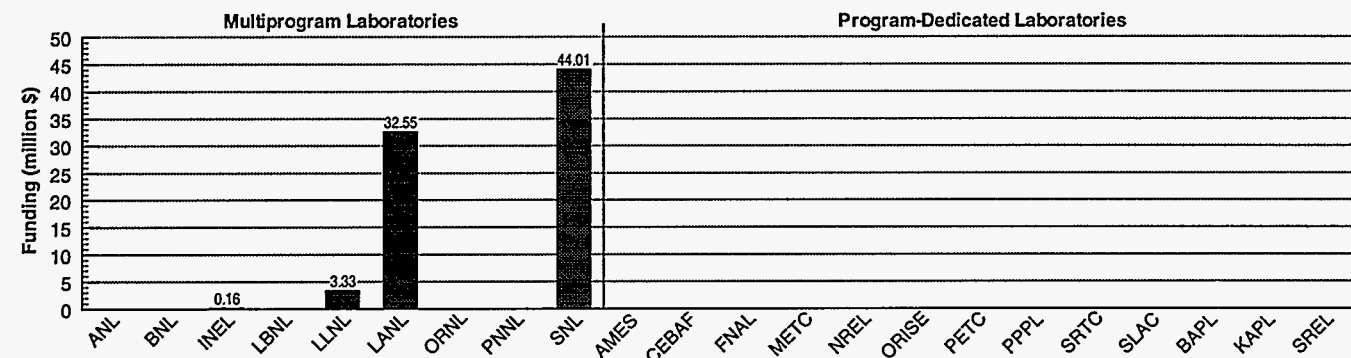
Laboratory-Academia-Industry Participation



Laboratories 100%

FY 1995 Data

Fiscal Year 1995 Funding Profile



Advanced Systems

Department of Energy Program

Program: Nonproliferation and National Security
Office: Research and Development
Element: Advanced Systems
B&R Code: GC0404

Laboratory Complex

Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: ANL, BNL, INEL, ORNL, PNNL

Mission Activity Description

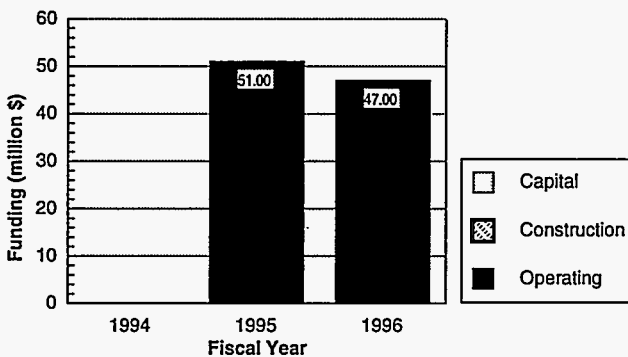
Verification and Control Technology Advanced Systems programs are structured to encourage new and innovative thinking on technological solutions to U.S. treaty verification and proliferation detection capabilities. In addition to numerous individual small exploratory efforts, two major programs are supported in the areas of laser-based remote measurement methods and multisensor systems research.

A laser-based chemical analysis and identification program is under way. It aims to provide unparalleled standoff proliferation detection capabilities through the use of novel techniques and to result in significant advances in sensitivity and selectivity in remotely detecting and monitoring chemical effluents. This activity is being coordinated across the U.S. Government by the Nonproliferation and Arms Control Technology Working Group, in order to minimize any overlap with similar laser-based sensing activities under way outside the Department of Energy. This initiative is referred to as the Chemical Analysis by Laser Interrogation of Proliferation Effluents project. The effort has begun with optical signature analyses, leading to laboratory and field testing, then progressing where feasible to field proof-of-concept demonstrations.

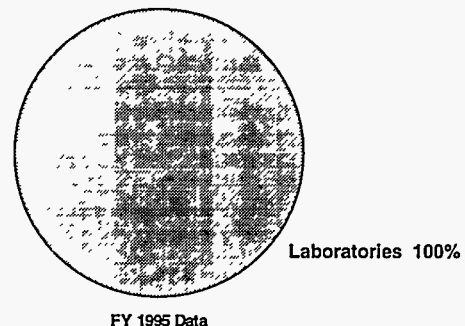
The multisensor systems research program develops advanced computer methods for converting massive amounts of data to usable information in a timely manner. The program explores methods and levels of data fusion to exploit the potential synergism in multisensor data collection. An example of a project in this program is deployable adaptive event recognition and processing systems. The purpose of this project is to develop and test prototype neural network hardware to accomplish adaptive event recognition and processing for a variety of applications, including small satellite, airborne, and ground-based nonproliferation efforts.

Exploratory research advanced concepts projects are supported at each of the national laboratories covering the full scope of treaty verification and nonproliferation problems. These activities are often high-risk, proof-of-concept efforts which, if proven, promise to provide the basis for new projects.

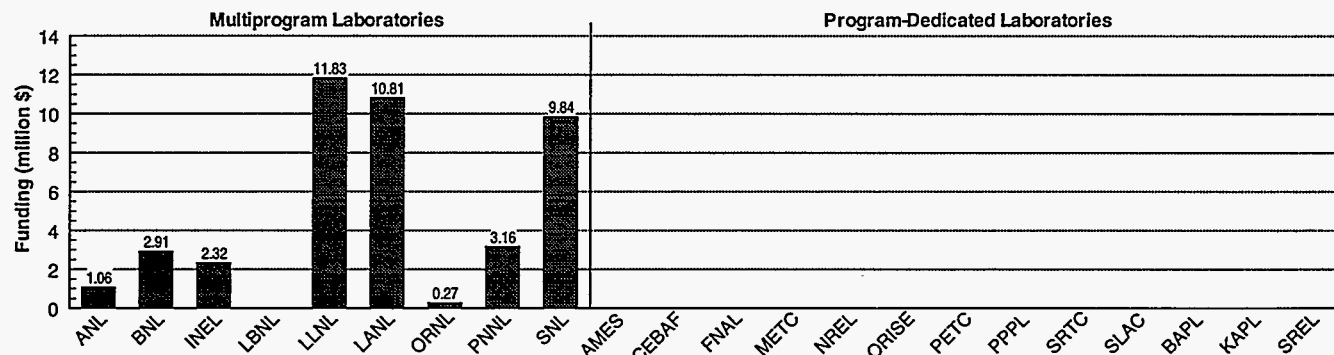
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Arms Control and Nonproliferation

Department of Energy Program

Program: Nonproliferation and National Security
Office: Arms Control and Nonproliferation
Element: Arms Control and Nonproliferation
B&R Code: GJ07, GJ06, GJ04, GJ01, GJ02

Laboratory Complex

Principal Laboratory: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: ANL, BNL, INEL, ORISE, ORNL, PNNL

Mission Activity Description

This activity consists of the following five major functional areas:

Secure Nuclear Materials and Expertise in the Former Soviet Union—The essential limiting factor in the ability to manufacture a nuclear weapon is fissile material. Activities included in this category are cooperation with former Soviet Union nations on protection, control, and accounting of weapons-usable nuclear material. Activities to prevent nuclear smuggling, prevent "brain drain," and increase industrial partnering programs are also consolidated here.

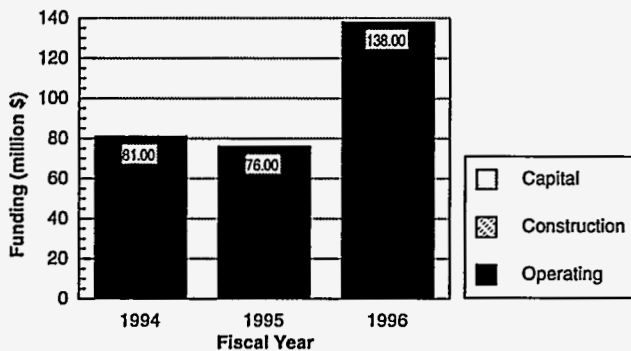
Limit Weapons-Usable Fissile Materials—The cessation of the use of weapons-grade plutonium from production reactors, elimination of the civil use of highly enriched uranium (HEU) and promotion of alternatives to the civil use of plutonium, reduction of stockpiles of HEU and plutonium, and efforts to initiate regional fissile material control activities and disposition of weapons-usable materials are included under this broad category.

Establish Transparent and Irreversible Nuclear Reductions—Transparency refers to the need for nations to confirm dismantlement and nonreuse of warheads and materials. Irreversibility means ensuring that materials declared excess to security needs are not reused in nuclear weapons. Activities incorporated in this category include efforts to expand negotiated weapons reductions and to implement LANL's purchase of 500 tonnes of HEU from dismantled Russian warheads.

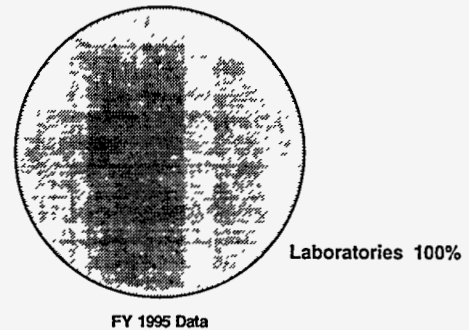
Strengthen the Nuclear Nonproliferation Regime—This category combines those activities that relate to treaties and agreements, such as compliance with the Non-Proliferation Treaty, negotiations for the Comprehensive Nuclear Test Ban Treaty, support for IAEA inspections and effectiveness, and promotion of regional safeguards and nonproliferation measures.

Control Nuclear Exports—Programs to control nuclear exports, including assistance to states of the former Soviet Union, reform of statutory licensing requirements, strengthening of multilateral supplier initiatives, and the promotion of expanded information sharing and analysis are considered here as a single category.

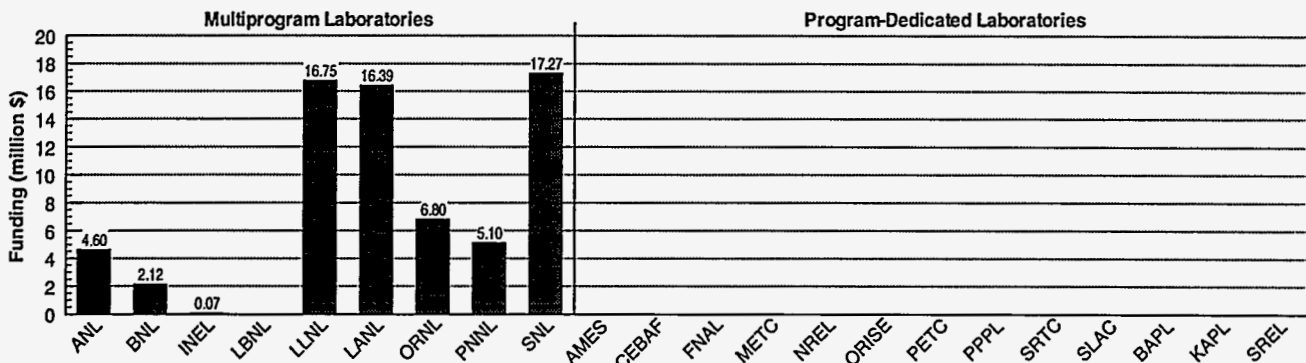
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Analytical Support

Department of Energy Program

Program: Nonproliferation and National Security
Office: Energy Intelligence
Element: Nuclear Nonproliferation
B&R Code: NT0101, NT0102, NT0103, NT0104

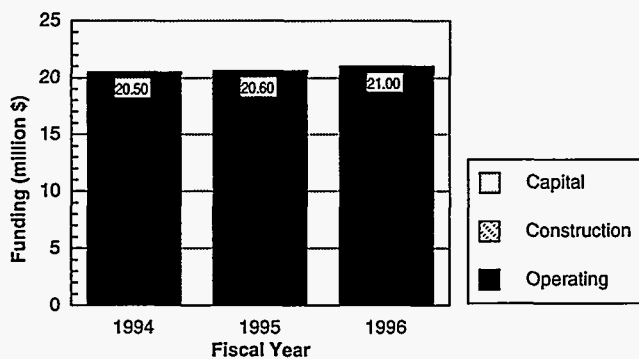
Laboratory Complex

Principal Laboratory: LANL, LLNL, PNNL
Contributing Laboratories: SNL
Participating Laboratories: ANL, INEL, ORNL, SRTC

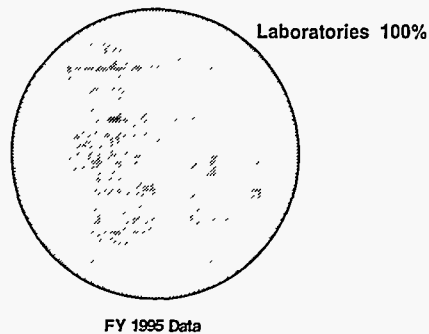
Mission Activity Description

Analytical support is provided for intelligence assessments of foreign government policies and market developments that could affect long-term supply and demand for energy resources worldwide, including price and availability, estimated changes in demand in the mix of energy uses, and assessments of the stability of world and regional economies. Monitoring and analyses of safety and environmental issues pertaining to foreign nuclear energy programs are provided, including ranking the safety of foreign nuclear reactors, assessing potential and existing radioactive contamination, particularly in the republics of the former Soviet Union. Support is provided in the ongoing analysis of potential, existing, and advanced nuclear weapons activities worldwide and the threat to the United States from these activities. Analyses of nuclear capability in proliferant countries is provided, consistent with the Secretary of Energy's goal of addressing increased global nuclear proliferation challenges.

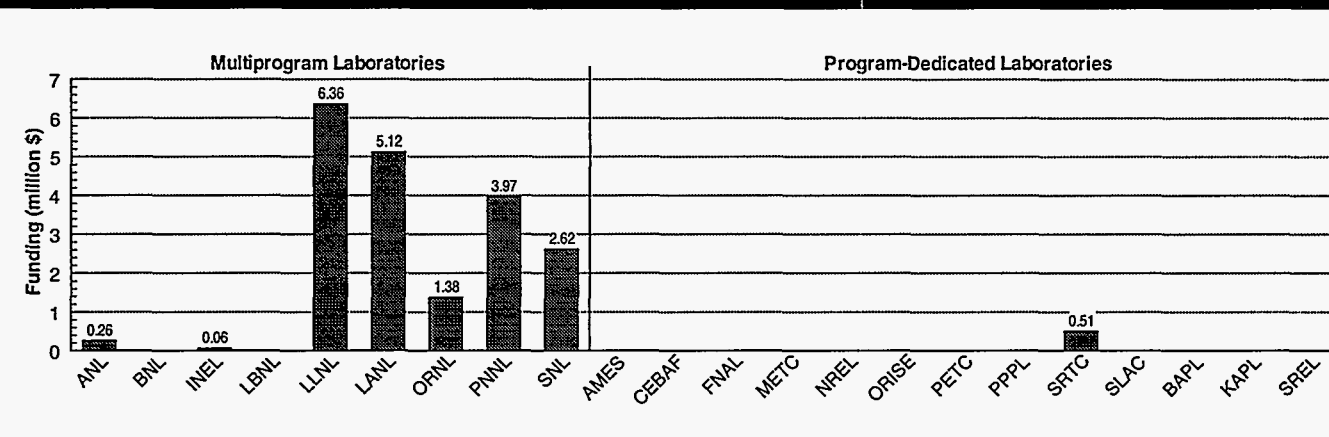
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Threat Assessment

Department of Energy Program

Program: Nonproliferation and National Security
 Office: Energy Intelligence
 Element: Energy Assessments
 B&R Code: NT0201, NT0203

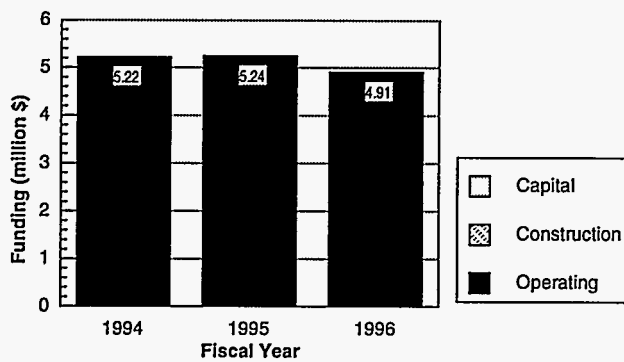
Laboratory Complex

Principal Laboratories: INEL, ORNL, SRTC
 Contributing Laboratories: None
 Participating Laboratories: ANL, PNNL, SNL

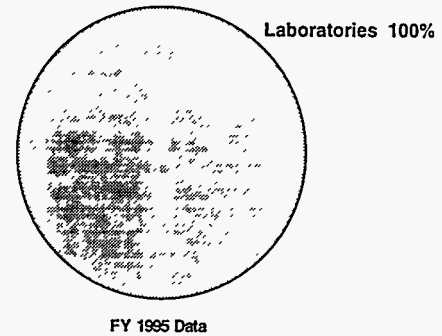
Mission Activity Description

Threat assessment support is provided with a focus on energy-management-related assessments in various areas of the country. Specialized studies are conducted in specific areas of the foreign threat spectrum. Foreign and domestic terrorism activities are monitored and analyzed. The threat assessment database is maintained. Support provides nuclear/energy threat awareness training directed at the intelligence and law enforcement communities; provides communicated threat credibility assessments by maintaining and enhancing the capability to provide technical, operational, and behavioral assessments of specific threats involving nuclear material or Department facilities; provides analyses of nuclear material black market incidents and trends; supports the conduct of technology assessments of worldwide state-of-the-art applied research and technical development activities related to counterterrorism, counternarcotics, intelligence, and other departmental national security responsibilities; and provides support to the Department's 24-hour on-call intelligence and technical response activity.

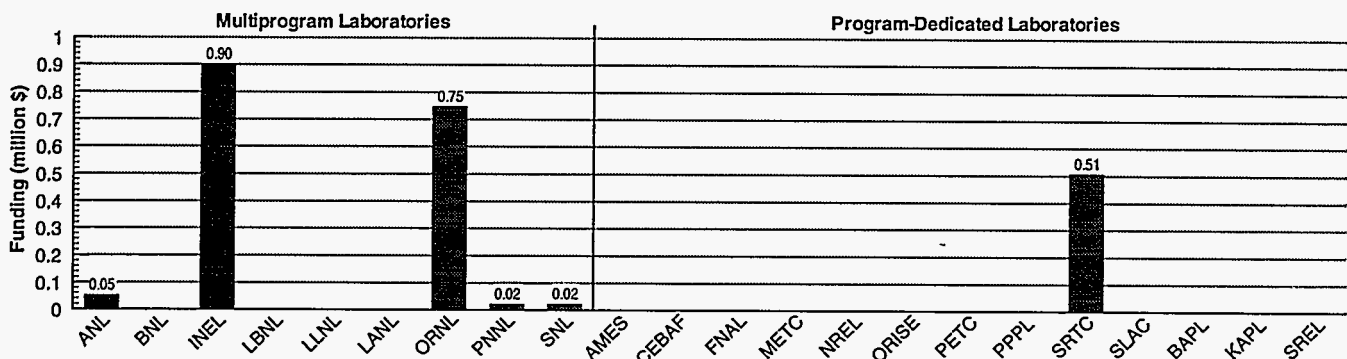
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Counter Intelligence

Department of Energy Program

Program: Nonproliferation and National Security
 Office: Energy Intelligence
 Element: Counter Intelligence
 B&R Code: NT0301

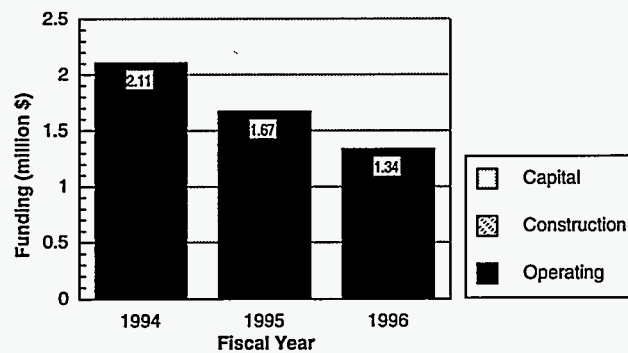
Laboratory Complex

Principal Laboratory: PNNL
 Contributing Laboratories: None
 Participating Laboratories: INEL

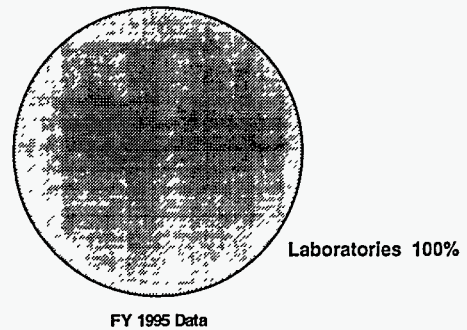
Mission Activity Description

Counter Intelligence support provides analysis in support of nuclear weapons nonproliferation, provides awareness training and threat briefings and debriefings, provides comprehensive foreign traveler briefings and debriefings for DOE travelers and hosts, and provides support as necessary to the Department's treaty implementation activities. This activity provides analysis for counter intelligence activities as described in Executive Order 12333.

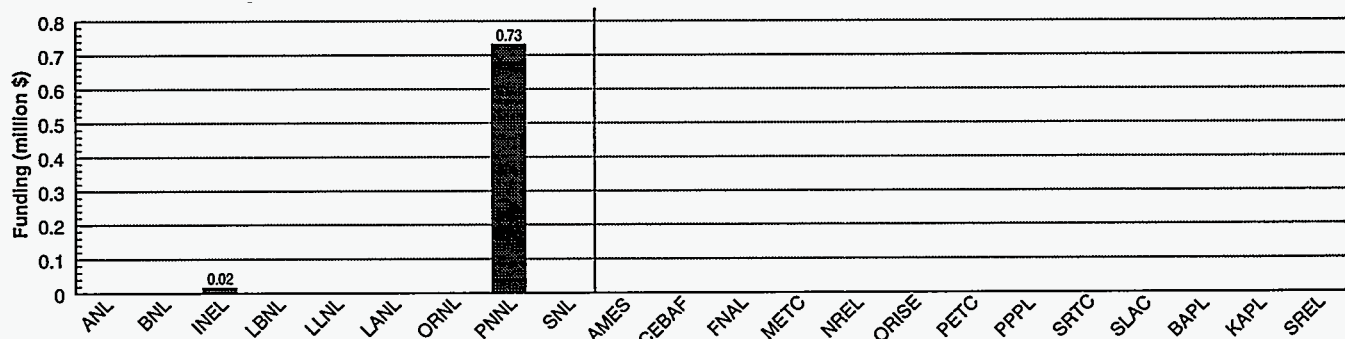
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Technical Support

Department of Energy Program

Program: Nonproliferation and National Security
Office: Energy Intelligence
Element: Intelligence Support
B&R Code: NT04

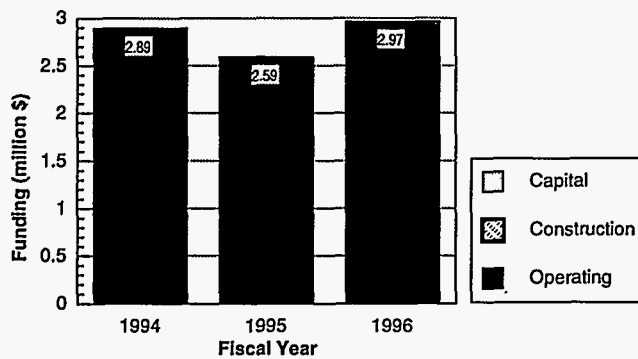
Laboratory Complex

Principal Laboratory: PNNL
Contributing Laboratories: LANL, LLNL
Participating Laboratories: SNL, SRTC

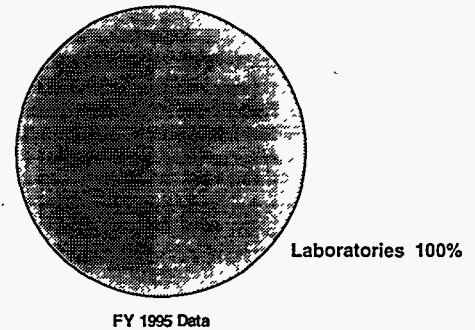
Mission Activity Description

This activity provides technical support for the maintenance of information networks and systems and, additionally, multispectral analysis of imagery data in support of laboratory intelligence activities.

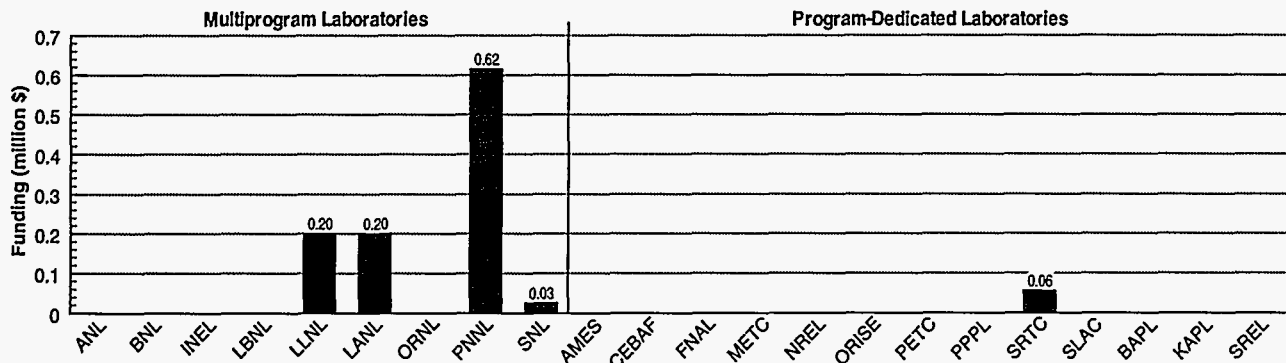
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Technology Development

Department of Energy Program

Program: Nonproliferation and National Security
Office: Nuclear Safeguards and Security
Element: Science and Technology Development
B&R Code: GD06

Laboratory Complex

Principal Laboratory: LANL, SNL
Contributing Laboratories: LLNL, ORNL
Participating Laboratories: ANL, BNL

Mission Activity Description

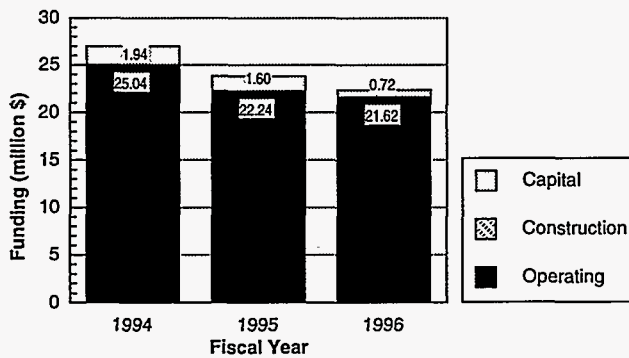
This activity is to develop state-of-the-art technologies related to safeguarding the Department of Energy's facilities, nuclear weapons, nuclear materials, and classified material. Specifically, the program addresses identified safeguards and security deficiencies and policy objectives with technological solutions. The program provides the technical base for other DOE programs as well as for other agencies and foreign countries. The systematic development of these technologies may require a technology to progress through three different stages science technology development, concept demonstration, and full-scale demonstration.

Material Control and Accounting—The material control and accounting program provides the required capabilities to accurately measure special nuclear materials, account for their quantity and location, provide measures to control and detect access to these materials, and to detect their theft or unauthorized diversion. Research efforts are focused in nuclear material measurements, nuclear material accounting, material control, and statistical methods.

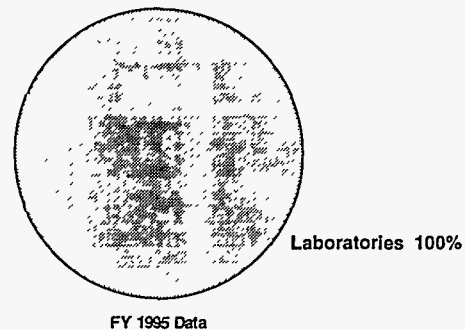
Physical Security—The physical security portion of the program develops physical protection technologies and systems for the purpose of preserving national security, protecting key assets, eliminating maintenance costs of old systems, and reducing recurring high costs for manpower. Research efforts are focused in the areas of detection, access control, access delay, alarm control and display, and personnel subsystems.

Information Security—The information security portion of the program is concerned with protecting classified and sensitive information from unauthorized users. Activities are focused on advice and assessment, education and awareness, incident response, tools and technology, and integration and assurance.

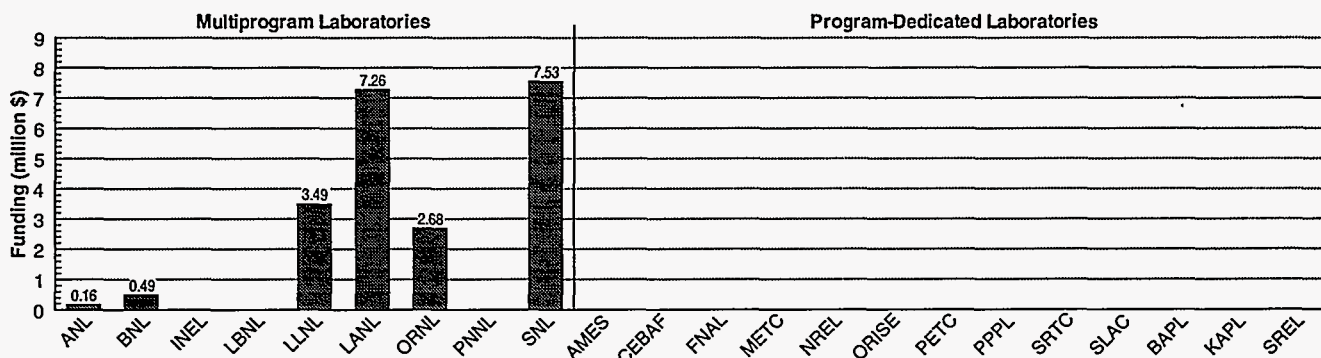
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Storage Options

Department of Energy Program

Program: Fissile Materials Disposition
Office: Office of the Technical Director
Element: Fissile Materials Storage Options
B&R Code: GA0101

Laboratory Complex

Principal Laboratory: LANL, LLNL
Supporting laboratories: None
Participating Laboratories: ORNL, PNNL, SNL

Mission Activity Description

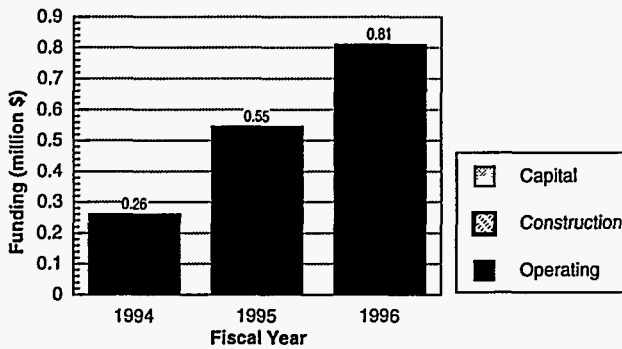
The Storage Options element of the Fissile Materials Disposition Program supports the National Security Mission by providing alternatives for the safe, secure, environmentally sound future storage of the Department's weapons-usable fissile materials (plutonium and highly enriched uranium) and encouraging reciprocal actions abroad. Currently the Department's plutonium inventory is located at numerous sites across the DOE complex which are not suitable for the long-term storage of plutonium.

The Program is preparing design, cost, schedule, nonproliferation, and environmental analyses of storage alternatives (options) in order to prepare a Programmatic Environmental Impact Statement (PEIS) and a Record of Decision. These storage alternatives include: (1) continued storage in existing facilities (no action), (2) upgrade of current facilities, and (3) consolidated storage in a new facility.

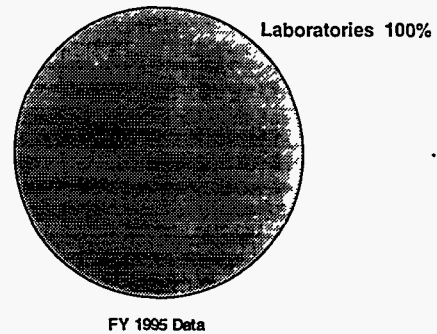
Laboratory technical and scientific support in this program element is focused on providing storage facility evaluation data to support the PEIS and Record of Decision based on their technical expertise and current responsibilities associated with the storage and management of these materials. This includes the evaluation of new facility designs and upgrades to existing facilities that are being evaluated in the PEIS as required by the National Environmental Policy Act (NEPA). Laboratory efforts also include addressing issues associated with the identification, preparation, and packaging of materials for storage, storage container design, and storage facility safety evaluations and compliance.

Additional National Security Mission-related efforts focus on the coordination of integral facility requirements such as material control and accountability, safeguards and security, surveillance, and transparency/inspectability. Plutonium storage expertise provided by LANL is also required to support the U.S./Russian Joint Study established to foster cooperation with Russian counterparts on the evaluation of plutonium storage and disposition options and to implement small scale technology demonstrations.

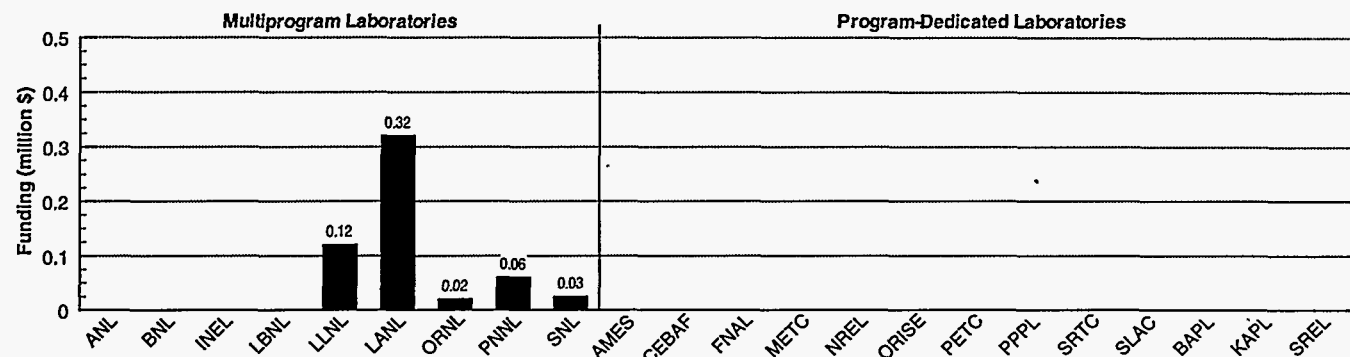
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Disposition Options

Department of Energy Program

Program: Fissile Materials Disposition
Office: Office of the Technical Director
Element: Fissile Materials Disposition Options
B&R Code: GA0102

Laboratory Complex

Principal Laboratory: LLNL, ORNL
Contributing Laboratories: LANL
Participating Laboratories: ANL, BNL, INEL, SNL, PNNL

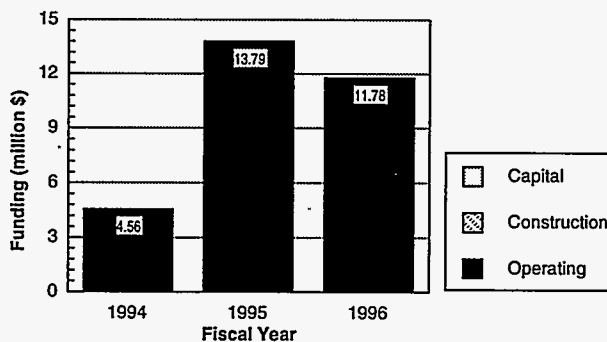
Mission Activity Description

The Disposition Options element of the Fissile Materials Disposition Program supports the National Security Mission by providing alternatives for the disposition of weapons-usable fissile materials declared surplus to national defense needs. The global stockpiles of plutonium and highly enriched uranium (HEU) pose a danger to national and international security in the form of potential proliferation of nuclear weapons if not properly managed and safeguarded. The disposition of these materials directly contributes to the advancement of U.S. and global nonproliferation interests. This activity provides design, cost, schedule, nonproliferation and environmental analyses of disposition options in order to support the preparation of Programmatic Environmental Impact Statements and Record(s) of Decision.

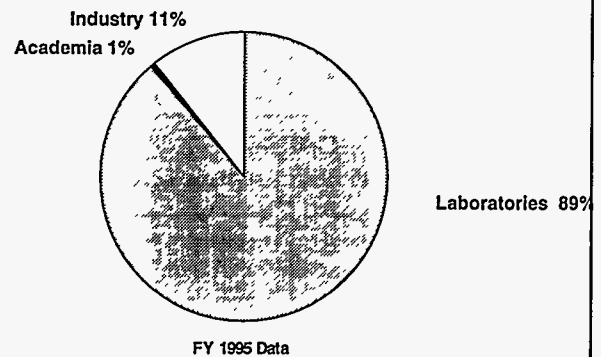
The proposed options for surplus plutonium disposition include conversion to mixed oxide fuel for use in nuclear power reactors, immobilization in glass or other materials, and direct geologic disposition in deep boreholes drilled into the earth. Options for surplus HEU disposition include continued storage as HEU, blending down for use as reactor fuel, and blending down for disposal as waste. The selected national laboratories are evaluating these disposition options based on their expertise in nuclear material management and material science in addition to their role in the development of nuclear waste cleanup technologies.

Options for dealing with fissile material disposition are complex and require substantial analysis and integration across national laboratories and Department facilities to address environmental impacts, technical viability, cost, schedule, and nonproliferation-related issues. This mission activity provides foundation for the selection of preferred options and assists the program in defining the path forward for the disposition of surplus fissile materials.

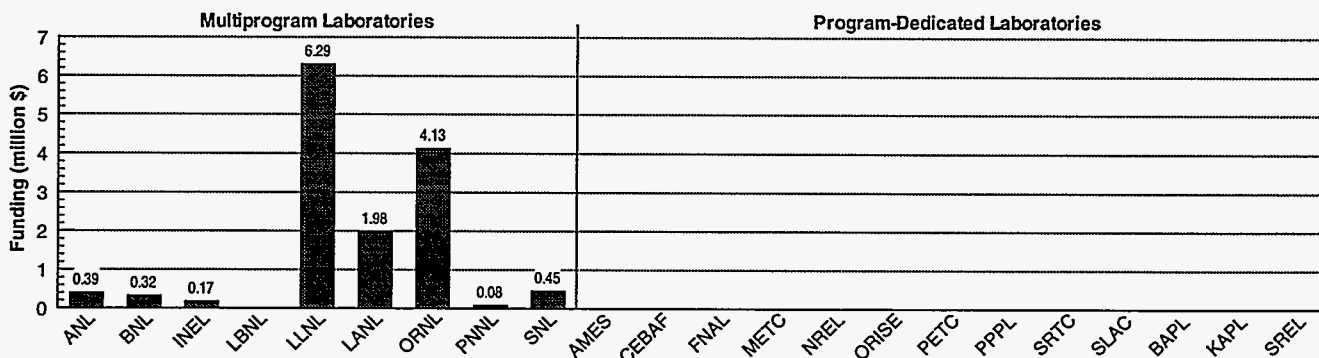
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Technical Integration

Department of Energy Program

Program: Fissile Materials Disposition
Office: Office of the Technical Director
Element: Technical Integration, Support, and Associated Technologies
B&R Code: GA0103

Laboratory Complex

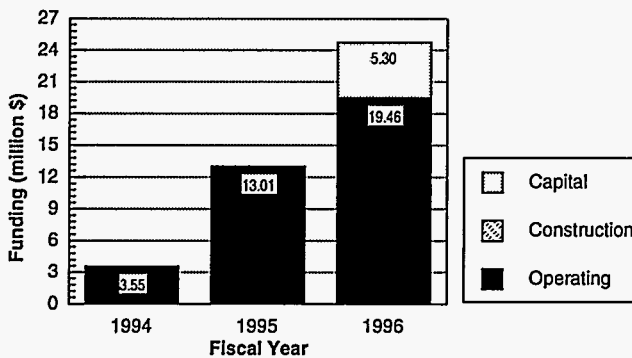
Principal Laboratory: LANL, SNL
Contributing Laboratories: LLNL
Participating Laboratories: ORNL

Mission Activity Description

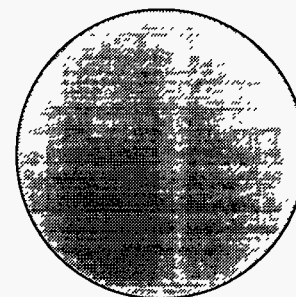
The Technical Integration, Support, and Associated Technologies element of the Fissile Materials Disposition Program provides systems engineering and laboratory/facility integration of technologies that are common to fissile material storage and disposition alternatives being evaluated by the Program. Some of the technologies contribute directly to the National Security Mission such as Safeguards & Security and nuclear weapon Pit Disassembly and Material Conversion. Others support program elements detailed in the Storage and Disposition Options tasks under the National Security Mission.

These technologies include: **Decision Analysis and Criteria** to provide the criteria and decision analysis methodology to evaluate and support the selection of potential disposition alternatives; **Systems Analysis** to define the system technology options and potential flow paths to be studied and coordinate the collection of data from candidate facilities and technologies to model the end-to-end performance of selected alternatives; **Safeguards and Security** to analyze domestic and international safeguards and security needs for the storage and disposition alternative analyses; **Technical Integration** to coordinate and integrate technical efforts laboratorywide; **Transportation and Packaging** to define issues and develop data input necessary to support material packaging requirements and offsite transportation between proposed facilities; **Automation and Robotics** to ensure that material disposition technologies are developed and evaluated with the consideration of appropriate automation and robotics technologies; **Pit Disassembly and Material Conversion** to develop methods to convert weapon pits into unclassified forms suitable for long-term storage and/or disposition options. The ARIES (Advanced Recovery and Integrated Extraction System) demonstration project, a joint LANL and LLNL effort, involves material technology and robotic systems for disassembling and converting nuclear weapon pits in a near zero waste manner.

Funding History



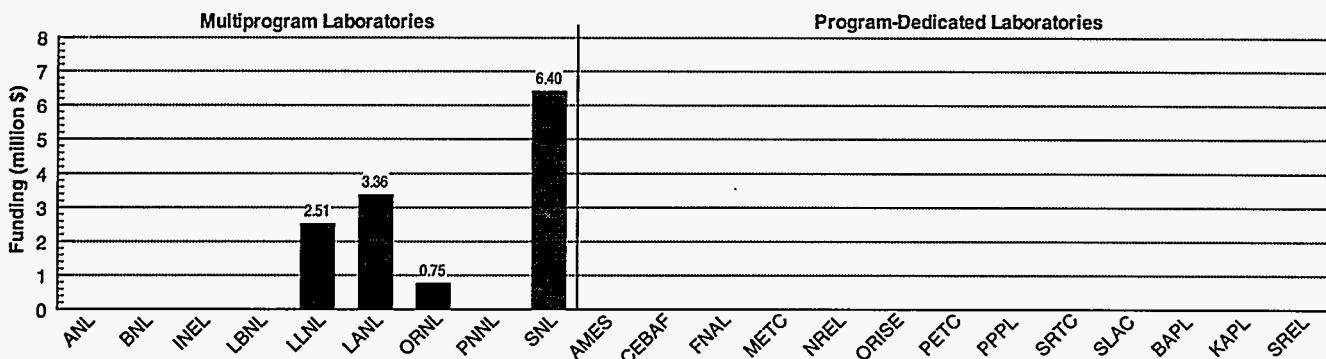
Laboratory-Academia-Industry Participation



Laboratories 100%

FY 1995 Data

Fiscal Year 1995 Funding Profile



Naval Reactor Development

Department of Energy Program

Program: Nuclear Energy
Office: Naval Nuclear Propulsion
Element: Naval Reactors Development
B&R Code: AJ0501, AJ050202, AJ050203, AJ050206, AJ0503, AJ0581, AJ20

Laboratory Complex

Principal Laboratories: BAPL
Contributing Laboratories: KAPL
Participating Laboratories: INEL

Mission Activity Description

Naval Reactors' mission is to provide the Navy with safe, militarily effective nuclear propulsion plants in keeping with the Nation's defense requirements and to ensure their continued safe and reliable operation. Naval Reactors is directly responsible for all aspects of naval nuclear propulsion from technology development through reactor operations to, ultimately, reactor plant disposal. The Navy will continue to rely on nuclear-powered warships, which comprise more than 40 percent of its major combatants. Activities include the following:

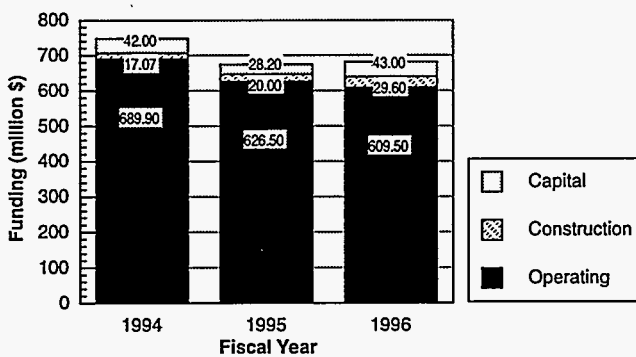
Reactor Technology and Analysis—Ensures continued safe and reliable operation of existing reactors and develops new reactors with improved power capabilities by exploiting advances in nuclear physics, reactor configuration, analytical modeling, and manufacturing and inspection methods.

Materials Development and Verification—Develops, qualifies, and tests nuclear fuel, poison, cladding, and structural and component materials suitable for use in the demanding environment of an operating nuclear plant. Materials must be capable of maintaining their structural and mechanical integrity over decades in a high-temperature, high-pressure, corrosive environment. Attention is given to testing and evaluating materials in use to verify acceptability for safe operation over a component's lifetime, to developing and applying new testing methods and insights, and to extending materials in use to new applications.

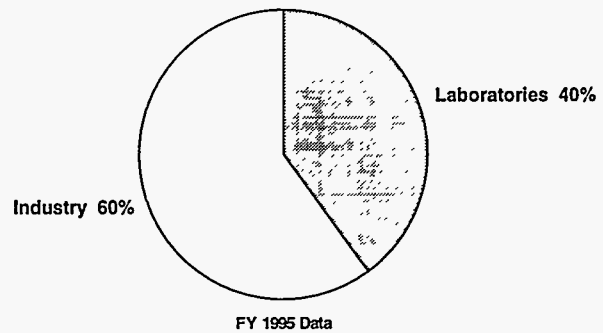
Plant Technology—Develops and analyzes equipment and systems that transfer, convert, store, control, and measure power created by the reactor. Work aims at maximizing plant performance and minimizing maintenance by evaluating existing components, integrating new technologies into current and new equipment designs, and proving concepts through testing.

Evaluation and Servicing—Operates, maintains, and services the program's land-based prototype naval nuclear propulsion plants and advanced test reactor plant. Testing of materials, components, cores, and systems in these plants provides important technical data and experience under actual operating conditions.

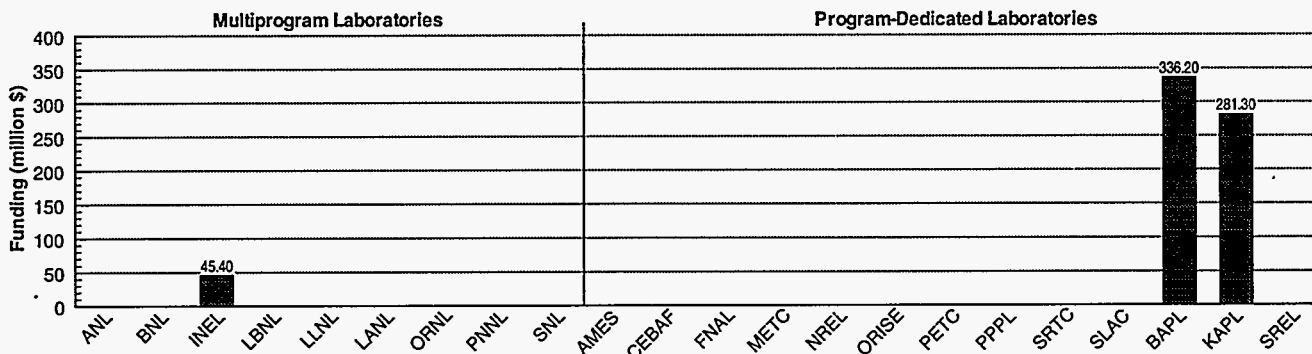
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Note: Totals prior to contracting from laboratories.

Advanced Clean Fuels

Department of Energy Program

Program: Fossil Energy
 Office: Coal Technology
 Element: Coal Conversion
 B&R Code: AA10

Laboratory Complex

Principal Laboratories: PETC
 Contributing Laboratories: METC
 Participating Laboratories: None

Mission Activity Description

The mission of Advanced Clean Fuels Research is to support development and advance the commercialization of clean, cost-effective coal processing technologies that produce coal-derived transportation fuels, chemicals, and other products, at costs competitive with oil-derived products.

To achieve its goals, Advanced Clean Fuels Research carries out key activities in the following areas:

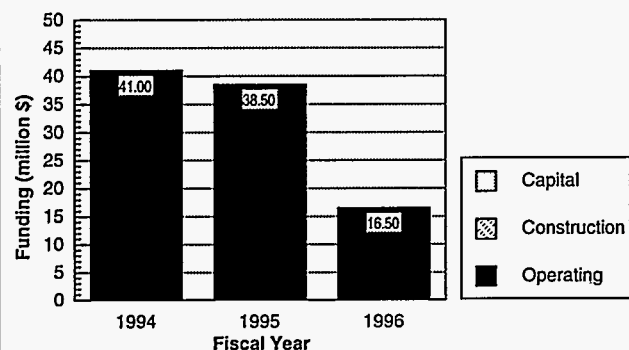
Coal Preparation—The coal preparation program is directed toward the development of coal cleaning technologies that will reduce the ash and sulfur content of U.S. coals so that the products can be formulated into high-quality fuels.

Direct Liquefaction—Direct liquefaction is the catalytic conversion of coal into light hydrocarbon liquids for the production of transportation fuels and chemicals using the existing petroleum-refining infrastructure.

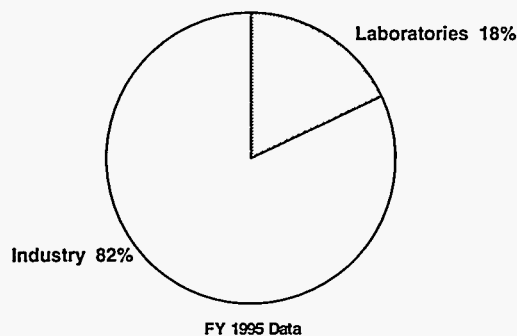
Indirect Liquefaction—Indirect liquefaction is the catalytic conversion of coal-derived synthesis gas into liquid fuels. The products resemble petroleum products that have already been refined and are ready to use.

Coproduction—Coproduction combines indirect liquefaction with an advanced power system to produce both electricity and methanol.

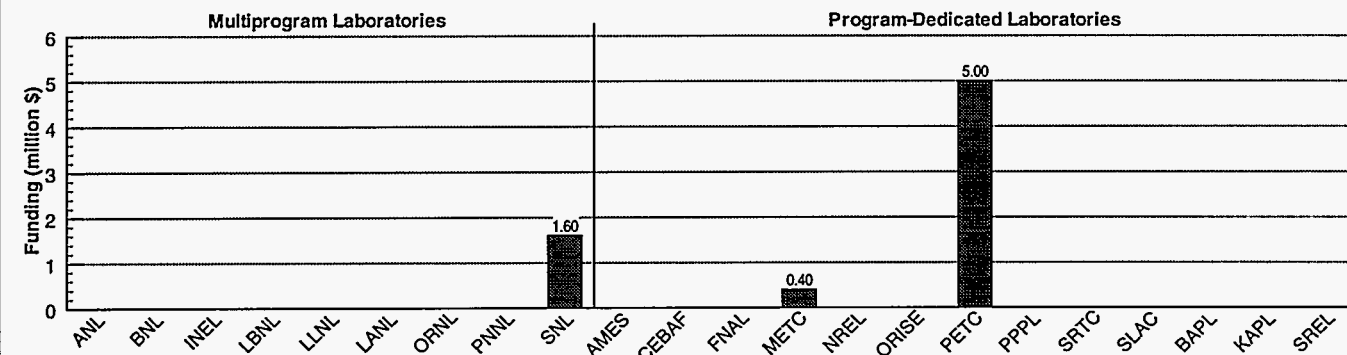
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Advanced Clean/Efficient Power Systems

Department of Energy Program

Program: Fossil Energy
Office: Coal Technology
Element: Coal Combustion and Control Systems
B&R Code: AA20

Laboratory Complex

Principal Laboratories: METC, PETC
Contributing Laboratories: None
Participating Laboratories: Ames, ANL, BNL, LBNL, NREL, ORNL

Mission Activity Description

The mission of the Advanced Power Systems activity is to accelerate commercialization of affordable, highly efficient, low-emission, coal-fueled electricity-generating technologies. To meet this mission goal, the coal research and development program is developing five categories of advanced power systems that hold the greatest promise for commercial use:

Advanced Pulverized Coal-Fired Powerplants—Advanced pulverized coal-fired powerplants take pulverized coal combustion a major step forward by redesigning the process to gain major performance improvements.

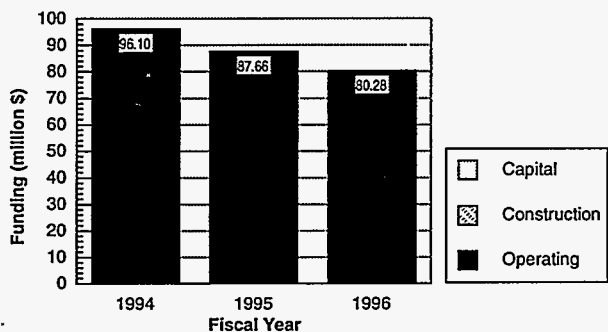
Indirect Fired Cycle Systems—Indirect fired cycle systems are coal-fired combined-cycle systems that produce energy cleanly and efficiently. The high-performance power systems incorporate new high-temperature advanced furnaces that integrate the combustion, heat transfer, and emission-control processes.

Pressurized Fluidized Bed Combustion—Pressurized fluidized bed combustion has several advantages over conventional pressurized combustion powerplants, including the high combustion and heat transfer inherent in fluid beds. The system utilizes combined-cycle power generation to maximize power production.

Integrated Gasifier Combined-Cycle Systems—Integrated gasifier combined-cycle systems replace the traditional coal combustor with a gasifier and gas turbine to provide highly efficient, cost-effective, and environmentally superior means for meeting the needs of the electric utility energy sector.

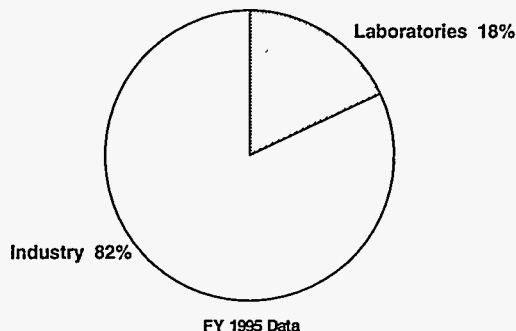
Advanced Gas Turbines—Advanced gas turbines for use with natural gas and coal applications will have ultrahigh efficiencies of 60 percent for utility application, and industrial systems will have a 15-percent improvement over today's best gas turbine system.

Funding History

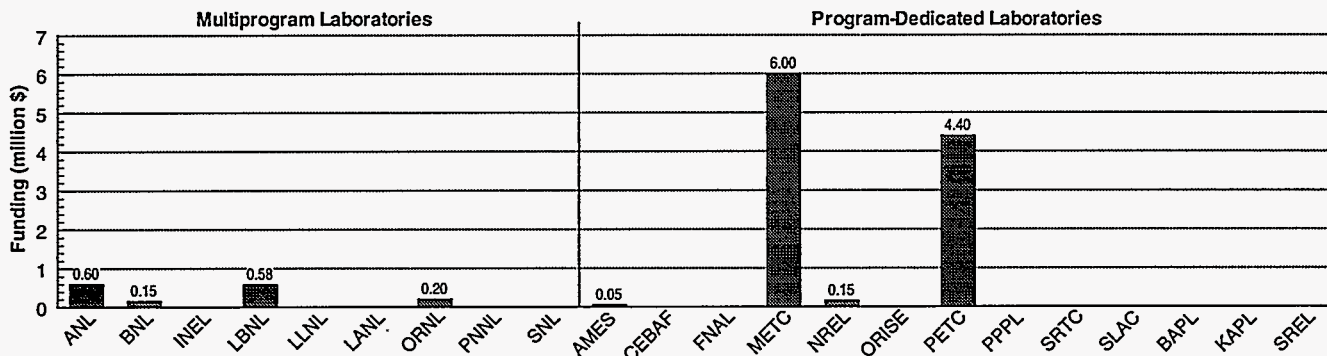


Note: Does not include advanced gas turbine activity, which is funded under Natural Gas.

Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Advanced Research and Technology Development

Department of Energy Program

Program: Fossil Energy
Office: Advanced Research and Special Technologies
Element: Advanced Research
B&R Code: AA15

Laboratory Complex

Principal Laboratories: ORNL
Contributing Laboratories: METC
Participating Laboratories: Ames, ANL, INEL, LANL, LBNL, LLNL, NIPER, NREL, PETC, PNNL, SNL

Mission Activity Description

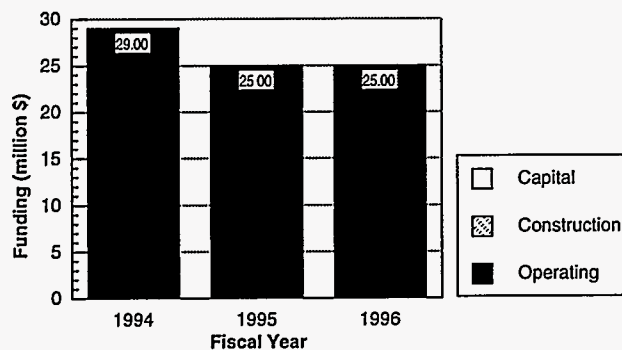
The mission of the advanced research programs is to conduct fundamental and exploratory research to establish the knowledge base necessary for new generations of fossil energy systems. The research products are fundamental scientific data and information to provide the understanding required for new generations of technology and novel new tools, techniques, process concepts, and materials to revolutionize system development. Research topics include coal science, combustion science, advanced materials, biotechnology, separations, catalytic science, and reaction chemistry. The science and technology base that is provided by the advanced research programs is broadly applicable, crosscutting multiple fossil energy systems power and fuel applications—gas-, oil-, or coal-fueled applications. Advanced Research and Technology Development comprises two activities:

Technology Crosscut—This activity supports a set of crosscutting studies and assessments in environmental activities, technical and economic analyses, coal technology exports, instrumentation and diagnostics, bioprocessing of coal, and international programs.

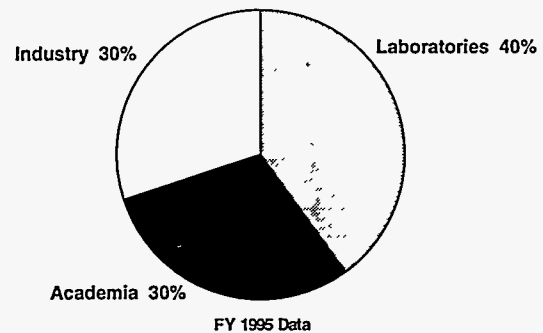
Research—This activity supports research in the following areas:

- **Coal utilization science** focuses on research pertinent to all coal utilization systems, with specific attention paid to increasing our knowledge of the principal mechanisms that control coal combustion processes.
- **Materials and components** research aims to develop advanced structural ceramic composites, structural alloys, coatings, and functional materials to enable development of advanced high-efficiency, economically competitive, and environmentally clean power systems and fuel conversion systems.
- **The university coal research program** aims to support grants to U.S. universities and colleges to conduct interdisciplinary research on the highest priority research needs identified throughout the broad mix of fossil energy technologies that use coal.

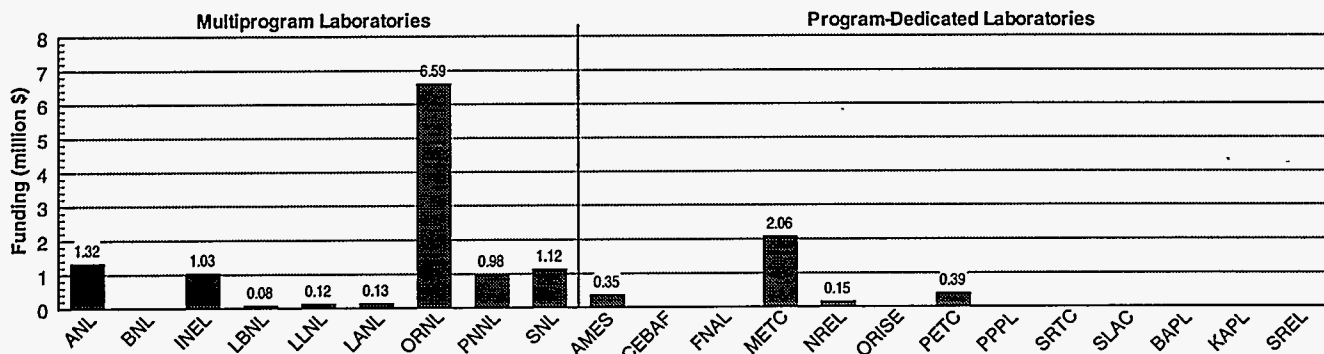
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Clean Coal Technology

Department of Energy Program

Program: Fossil Energy
Office: Coal Technology
Element: Clean Coal Technology
B&R Code: AZ

Laboratory Complex

Principal Laboratories: METC, PETC
Contributing Laboratories: None
Participating Laboratories: ANL, BNL, LANL, LLNL, NREL, ORNL

Mission Activity Description

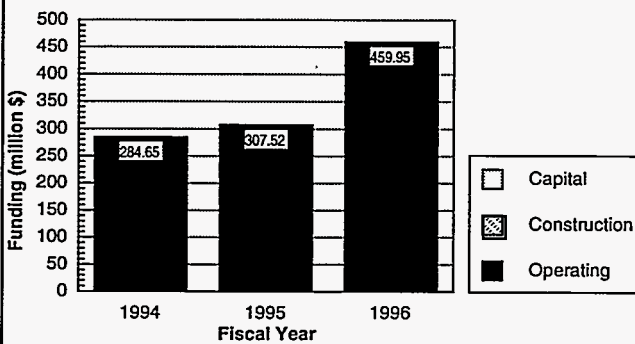
The Clean Coal Technology (CCT) Demonstration Program is an industry/government cost-shared effort to demonstrate advanced coal-based technologies. Most of the demonstrations are being conducted at commercial scale, in actual user environments, and under conditions typical of commercial operations. The technologies being demonstrated are categorized into four market sectors: (1) advanced electric power generation systems, (2) environmental control devices, (3) coal processing for clean fuels, and (4) industrial applications.

The program was administered through 5 competitive solicitations, resulting in the selection of more than 60 projects. The program currently consists of 42 major projects that have been awarded cooperative agreements and 1 project that is in negotiation. The cooperative agreements are administered by the program-dedicated laboratories, METC and PETC. More than 90 percent of the Department of Energy budget for the CCT Program is for direct funding of the major projects through the cooperative agreements.

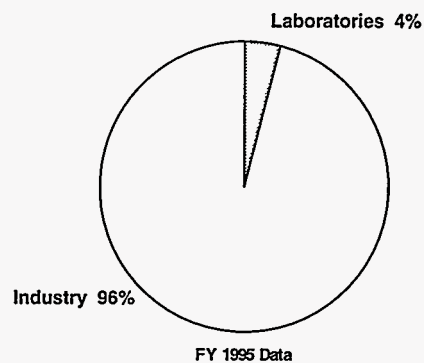
The majority of the task assignments at the multiprogram laboratories are related to the preparation of documentation in support of the National Environmental Policy Act. In addition to activities supporting the act, the laboratories have performed specialized studies and analyses that include:

- The development of a framework that allows the cross-referencing of process and environmental data for process designers and decisionmakers
- General environmental support concerning overall issues arising from air, water, and solid waste pollutants associated with the use of coal
- Analysis of alternative Federal and State market incentives for clean coal technologies, with emphasis on optimal design, implementation barriers, potential economic and financial impacts, and national or regional benefits from accelerated penetration of CCTs
- Development of a pilot training course on state-of-the-art technologies for electrical generation for developing countries

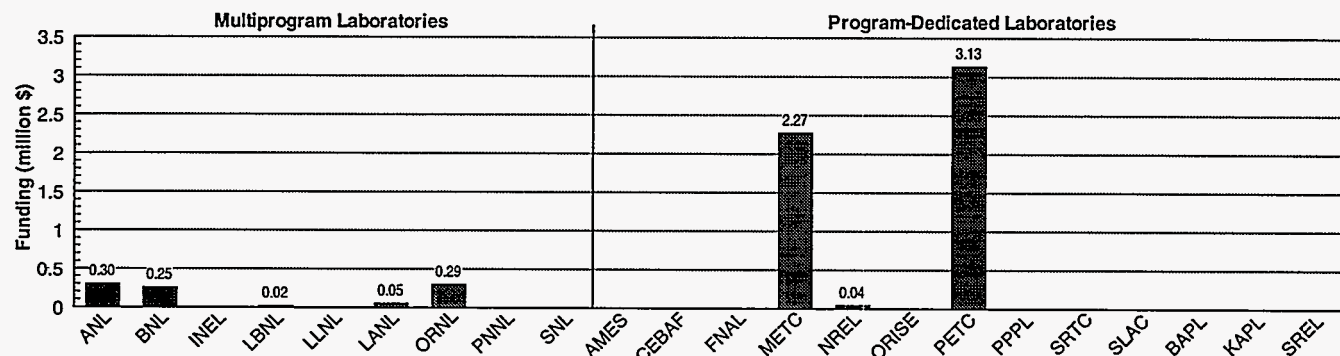
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Natural Gas Research

Department of Energy Program

Program: Fossil Energy
Office: Gas and Petroleum Technologies
Element: Natural Gas Research
B&R Code: AB05

Laboratory Complex

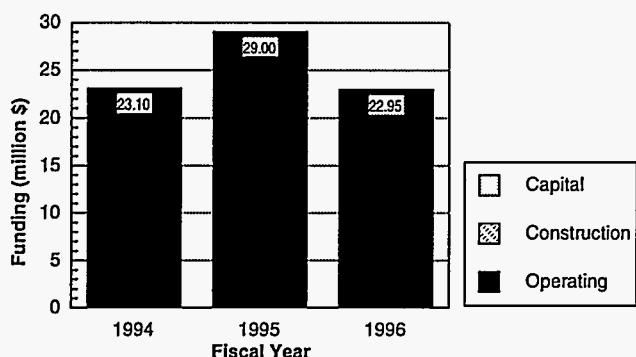
Principal Laboratories: METC
Contributing Laboratories: ANL, INEL, LBNL, SNL
Participating Laboratories: BNL, LANL, LLNL, PNNL

Mission Activity Description

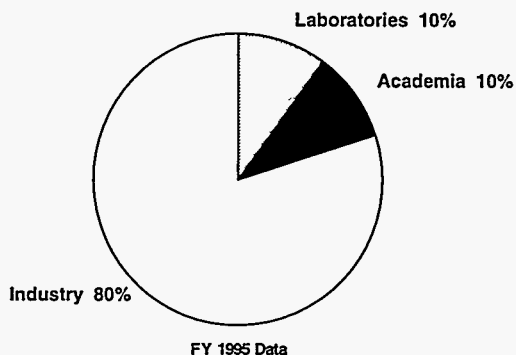
The competitive and clean-burning characteristics of natural gas give it a large and continuing role in the total energy outlook for the United States. To support the DOE goal of expanding the use of natural gas, the Office of Fossil Energy is researching, developing, and demonstrating clean, affordable technologies that will decrease the costs of producing, storing, and using natural gas; increase the reliability of gas supply; and use gas more efficiently. The Natural Gas Research, Development, and Demonstration Program is broken down into four program areas:

- **Resource and Extraction**—Enlarge and stabilize the domestic gas supply reserve base for a period adequate to increase public confidence in the long-term availability of affordable natural gas and to support increased use of gas
- **Utilization**—Develop advanced, high-efficiency, low-pollution technologies for natural gas use and to overcome obstacles to their adoption
- **Delivery and Storage**—Foster more efficient use of gas storage, demonstrate the reliability of peak-load deliverability of natural gas, and assist in the development of an information system for natural gas data that is accurate, timely, and reliable
- **Environmental/Regulatory Impact**—Reduce regulatory barriers to efficient market operations; promote sound, consistent, and efficient regulations based on improved scientific information; and ensure the availability of low-cost environmental technology to industry

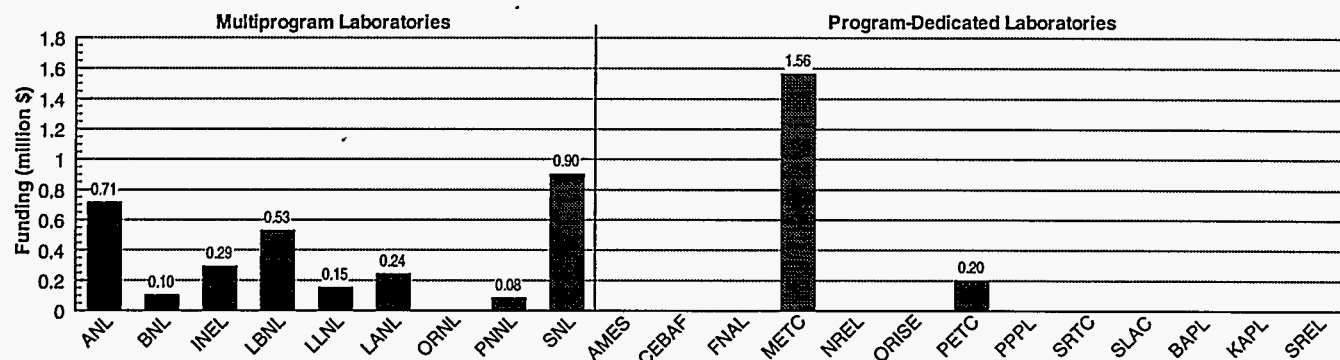
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Fuel Cells

Department of Energy Program

Program: Fossil Energy
 Office: Advanced Research and Special Technologies
 Element: Fuel Cells
 B&R Code: AB45

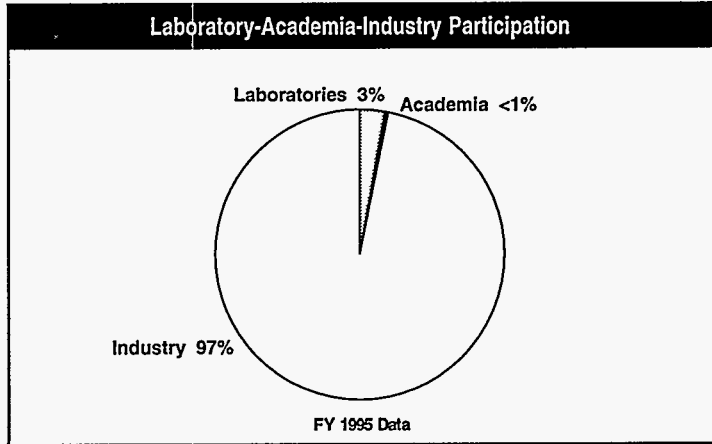
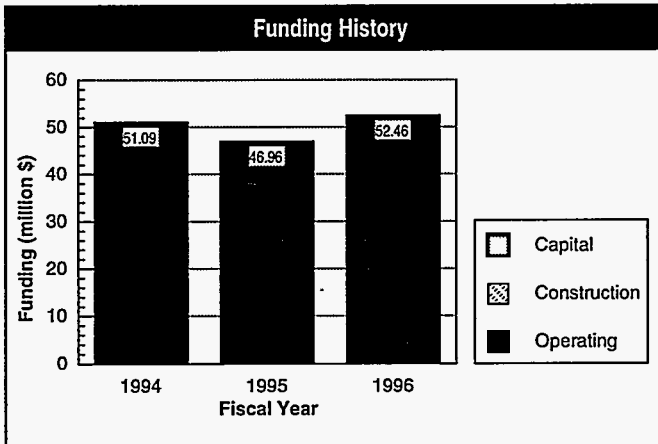
Laboratory Complex

Principal Laboratory: ANL, PNNL
 Contributing Laboratories: None
 Participating Laboratories: METC

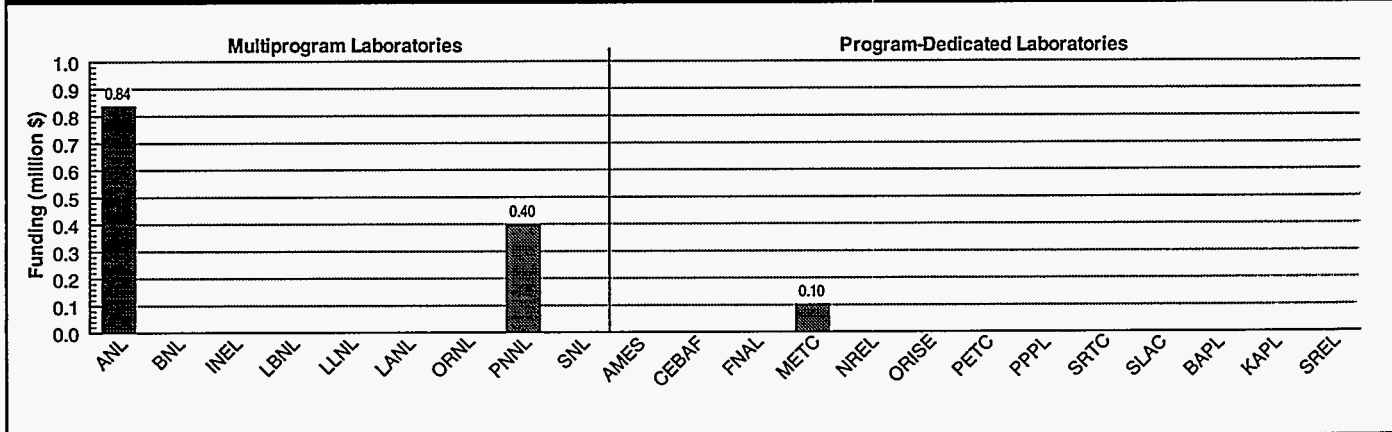
Mission Activity Description

Fuel cell activities focus on research and development (R&D), with the private sector, of cost-effective, efficient, and environmentally desirable fuel cell systems. The objectives are to develop fuel cell power generation systems that can be successfully commercialized in the 1990s by the private sector in utility, industrial, and commercial onsite power generation applications. Fuel cell activities support the Department's mission areas of achieving efficiency in energy, diversity in energy sources, a more productive and competitive economy, and improved environmental quality in partnership with DOE customers. The program fosters basic and applied R&D, proof-of-concept activities, precommercial field testing, and associated private-sector, commercial-scale activity. Key activities include the following:

- R&D of integrated fuel cell systems meeting functional requirements for utility-scale, distributed power, and onsite generation applications
- Development and field testing of performance and durability improvements and cost reduction that would enable private-sector production of competitive market entry powerplants by the year 2000
- Identification and research of advanced fuel cell concepts and configurations that would enable efficiencies of more than 70 percent (on lower heating value basis) and installed costs below \$1,000 per kilowatt for utility-scale, distributed power, and onsite generation
- Advanced research that would ensure availability of the critical materials and processes required for commercial market entry units before the year 2000 and advanced units by 2005
- Cooperation with private-sector commercialization activities to facilitate rapid cost reductions and rapid market penetration, enabling industry growth to annual sales exceeding \$1 billion early in the 21st century



Fiscal Year 1995 Funding Profile



Oil Technology

Department of Energy Program

Program: Fossil Energy
Office: Gas and Petroleum Technologies
Element: Oil Technology
B&R Code: AC10

Laboratory Complex

Principal Laboratories: INEL
Contributing Laboratories: LANL, LLNL, SNL
Participating Laboratories: ANL, BNL, LBNL, ORNL, PNNL

Mission Activity Description

The mission of the Oil Technology activity is to stimulate the domestic oil industry to maximize the supply of domestically produced liquid fuels and to expand exports of oil-related technologies and services of the United States. The activity seeks more efficient and economical methods to discover, produce, and refine oil while protecting the environment. The Oil Technology activity is broken down into four program areas:

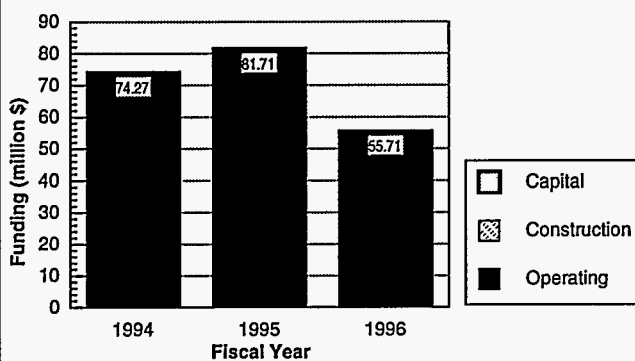
Exploration and Production Supporting Research—Assists in the development of light- and heavy-oil recovery technologies, exploration and production drilling research, risk management, and advanced extraction geoscience activities.

Recovery Field Demonstrations—Extend the economic production of domestic fields by slowing the rate of well abandonments and preserving industry infrastructure, and increase ultimate recovery in known fields by demonstrating better methods of reservoir characterization, advanced oil recovery and production technologies, advanced environmental compliance technologies, and improved reservoir management techniques.

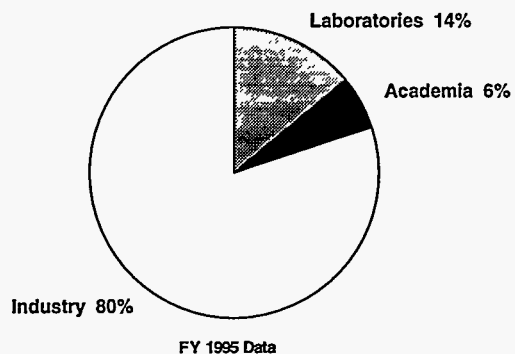
Exploration and Production Environmental Research—Reduces environmental costs to operators while improving their environmental performance, supports State, tribal, and Federal Government officials in making sound regulatory decisions, and promotes better communications with producers to assist them in environmental and regulatory problem solving.

Processing Research and Downstream Operations—Support and plan advanced refining, heavy-oil upgrading technology, and related environmental research. The scope of processing research is moving beyond fundamental research into helping industry deal with the trend toward heavier crude oil inputs and stricter, sometimes conflicting, environmental regulations.

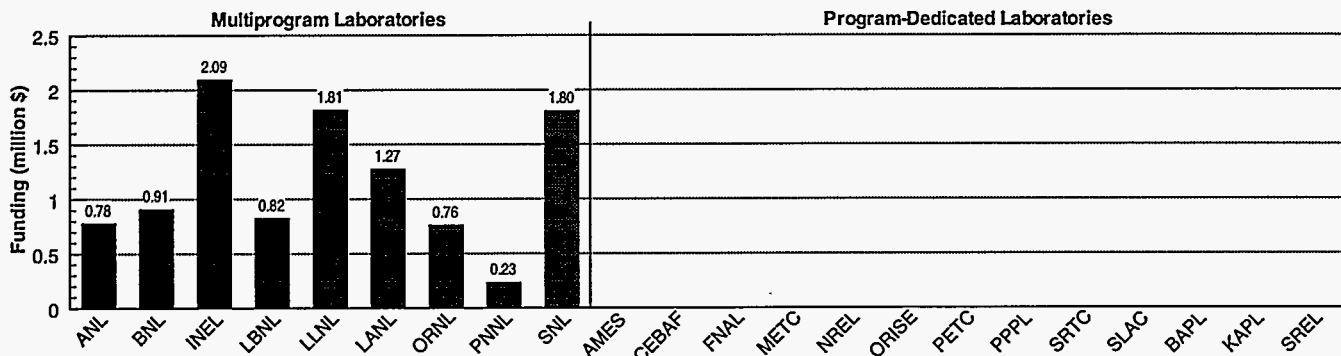
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Strategic Petroleum Reserve

Department of Energy Program

Program: Fossil Energy
 Office: Strategic Petroleum Reserve
 Element: Technical Management
 B&R Code: SA

Laboratory Complex

Principal Laboratories: SNL
 Contributing Laboratories: None
 Participating Laboratories: None

Mission Activity Description

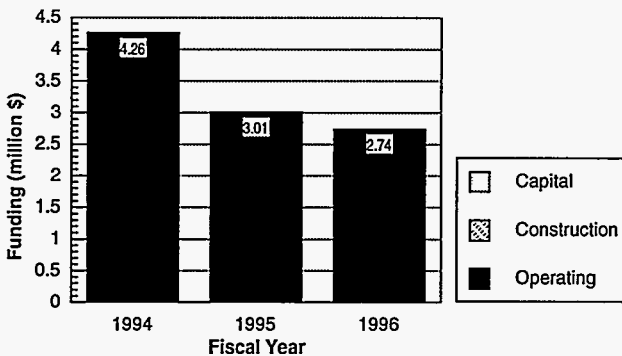
The Strategic Petroleum Reserve (SPR) is a large crude oil stockpile, under the control of the President of the United States. The SPR supports the energy resources mission to "ensure adequate supplies of clean, conventional energy, and reduce U.S. vulnerability to external events." The SPR mission is to reduce vulnerability to economic, national security, and foreign policy consequences of supply interruptions by discouraging supply disruptions as a tool of other nations and by adding to crude oil supplies in the United States, in the event of a disruption due to either political, military, or natural causes. The SPR supports the energy resources goal to ensure reliable energy services with reduced vulnerability to energy price and supply volatility by increasing reliance on risk-sharing mechanisms using a systems approach and promoting flexibility in the energy sector.

The SPR is mandated by the Energy Policy and Conservation Act, as amended, which originally required that a Strategic Petroleum Reserve be established as part of the Federal Energy Administration, a predecessor organization to the Department of Energy.

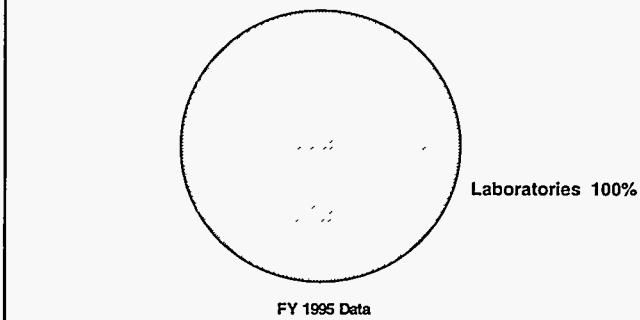
The geotechnical program provides technical, comprehensive, site-specific engineering research and development support to the planning, design, development, and monitoring of the SPR crude oil storage. Key elements of the tasks include geotechnical support for the decommissioning of Weeks Island; support for integrity testing, reviews of underground operations, and geotechnical support; oil quality work in the areas of hot and gassy oil and possible containment monitoring; and cavern mechanics.

The mission of the Reserve requires that each SPR site and terminal be capable of transitioning from operational readiness to full drawdown within 15 days. The engineering research support specifically addresses unknowns and concerns of a geotechnical nature related to development of underground caverns and mines. Failure(s) of the underground storage facilities would result in significant economic loss and inability to withdraw oil when needed and could result in environmental damage.

Funding History

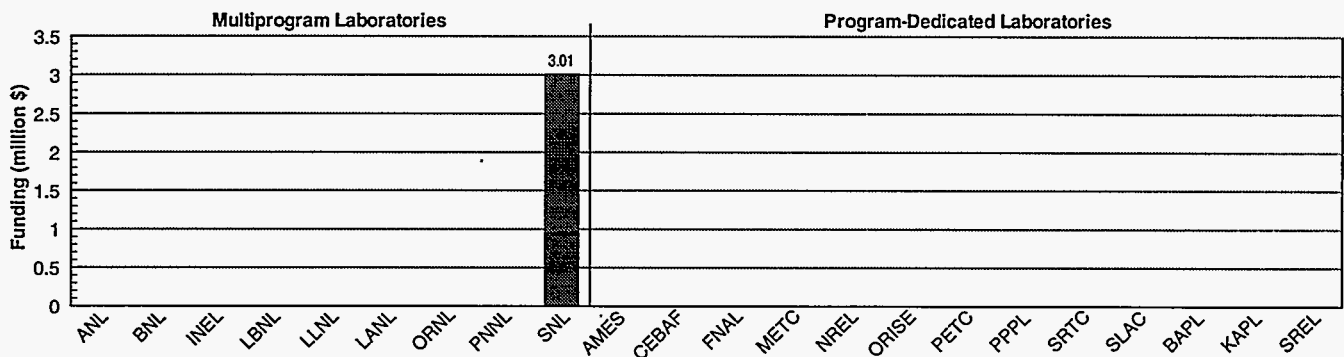


Laboratory-Academia-Industry Participation



Note: Funding for SPRO (\$240 million) not included here.

Fiscal Year 1995 Funding Profile



Light-Water Reactors

Department of Energy Program

Program: Nuclear Energy
Office: Science and Technology
Element: Engineering and Technology Development
B&R Code: AF11

Laboratory Complex

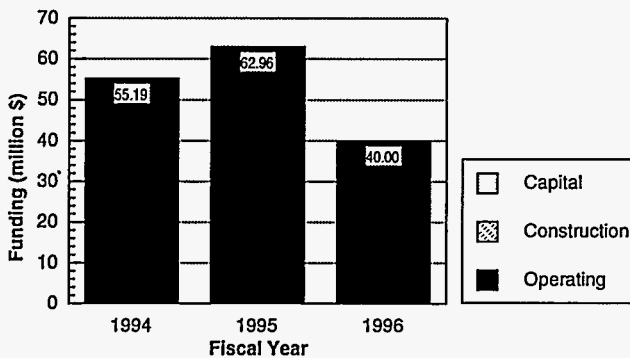
Principal Laboratories: SNL
Contributing Laboratories: None
Participating Laboratories: ANL, ORNL

Mission Activity Description

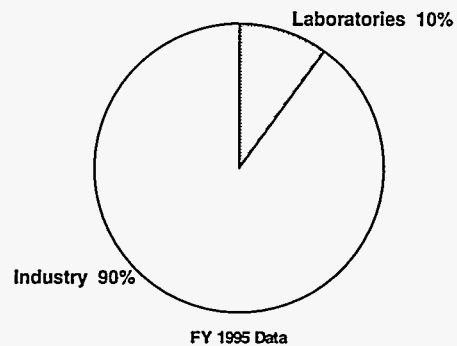
This activity is a nationally coordinated effort to meet the goals of elimination of barriers to efficient and cost-effective operation of nuclear powerplants, and maintaining exacting standards of safety in the design and operation of nuclear powerplants. A major focus of this cost-shared program is to make certified standardized advanced light-water reactors (ALWRs) available at the earliest possible date to ensure that nuclear power is an option to contribute to the new electrical capacity projected to be required by 2010. The program performs those activities necessary to ensure that ALWR orders can be based on marketplace decisions. It demonstrates a viable Nuclear Regulatory Commission (NRC) process by certification of two advanced evolutionary light-water reactor designs. It also develops and certifies the more passively safe, 600 MWe, simplified boiling water reactor (SBWR) and advanced passive pressurized water reactor (AP-600) plant concepts. This program provides for the continuation of the first-of-a-kind engineering (FOAKE) standardization activities to produce ALWR designs. All of the above activities are being carried out in coordination with the Utilities Nuclear Power Oversight Committee (NPOC) "Strategic Plan for Building New Nuclear Power Plants."

The Advanced Reactor Severe Accident Program (ARSAP) provides technology support to existing U.S. commercial operating powerplants and to the ALWR subprogram. It applies the results of the severe accident technology programs to the implementation of the Severe Accident Policy Statement for ALWRs to prevent severe accident issues from forestalling acceptance of ALWRs. The Commercial Light-Water Reactor subprogram develops technology to support the extension of nuclear powerplants' life beyond the current 40-year licensing period. It also contributes to development of the license renewal process.

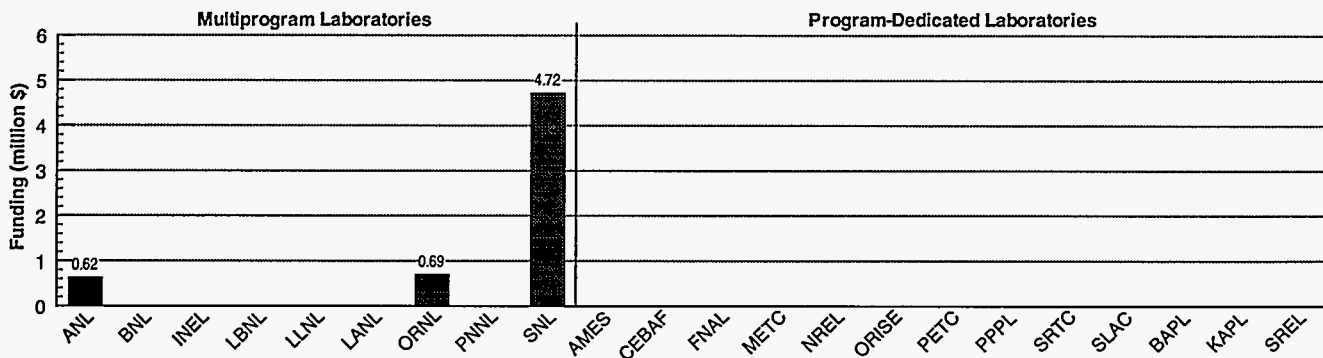
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Advanced Radioisotope Power Systems

Department of Energy Program

Program: Nuclear Energy
Office: Science and Technology
Element: Engineering and Technology Development
B&R Code: AF70

Laboratory Complex

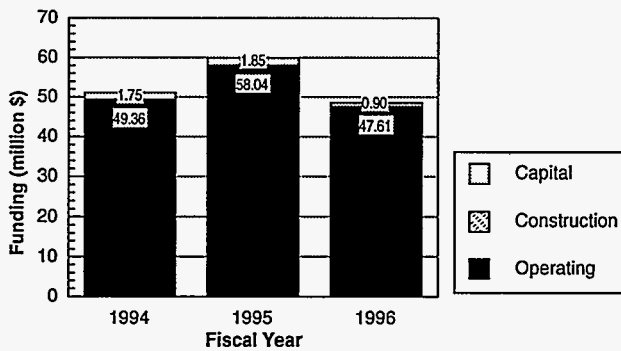
Principal Laboratories: LANL, ORNL
Contributing Laboratories: None
Participating Laboratories: Ames, SNL

Mission Activity Description

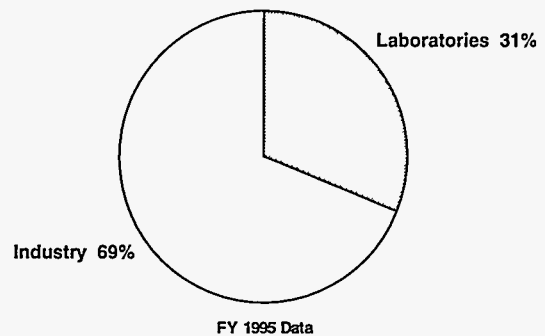
The Advanced Radioisotope Power Systems activity supports the Department of Energy science and technology mission to provide reliable energy resources, meeting important national goals in the areas of energy and national security through partnerships with other Federal agencies, including the National Aeronautics and Space Administration (NASA) and Department of Defense (DOD), and industry.

The Advanced Radioisotope Power Systems program maintains the sole national capability and facilities to produce radioisotope power systems. Program focus is on mission requirements of NASA, DOD, and other agencies. Projects are conducted with these agencies in accordance with memoranda of understanding and are dependent upon cost-sharing by the user agencies. Support is currently being provided to maintain fabrication and safety testing activities for NASA's Cassini mission, scheduled for launch in late 1997. Delivery of three new radioisotope thermoelectric generators (RTGs) and a requalified existing spare unit to the launch site 6 months prior to the Cassini launch is required. This activity supports the acquisition and processing of the required plutonium-238 fuel for Cassini and provides an inventory of flight-quality plutonium-238 for future NASA and DOD missions. This request provides for maintenance of facilities and skilled personnel; modernization and upgrades as required; and provides funding for generic nuclear energy studies, evaluations and safety support. Also provided is support for ongoing special-purpose terrestrial power sources utilized by other Federal agencies.

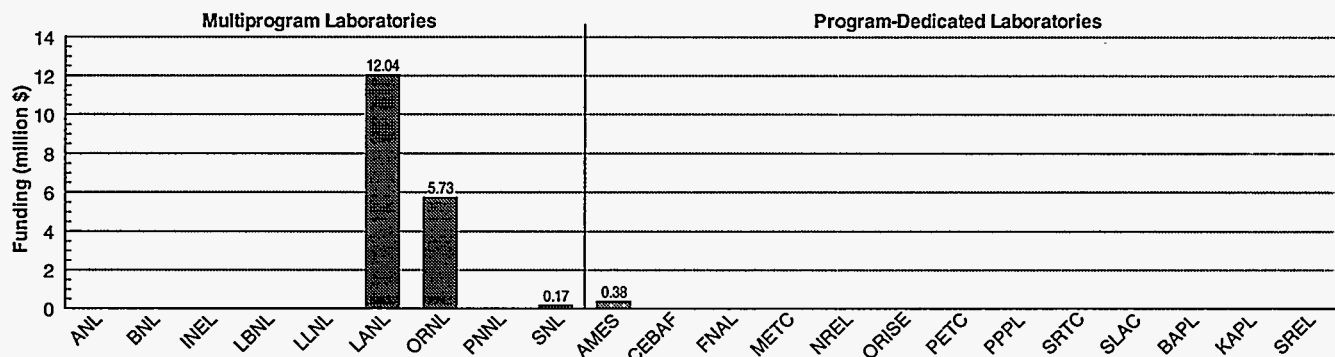
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Nuclear Technology Research and Development

Department of Energy Program

Program: Nuclear Energy
Office: Science and Technology
Element: Nuclear Technology Research and Development
B&R Code: AF50

Laboratory Complex

Principal Laboratories: ANL
Contributing Laboratories: None
Participating Laboratories: None

Mission Activity Description

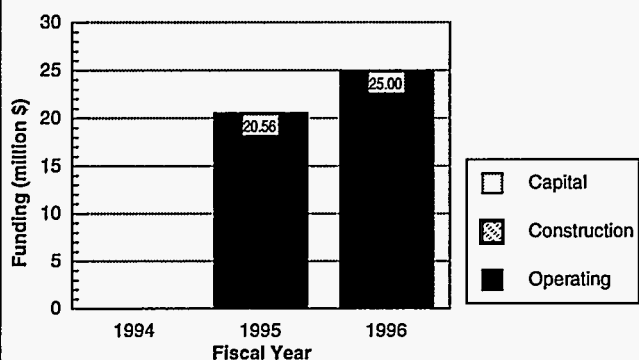
The Nuclear Technology Research and Development (R&D) activity provides funding to support R&D on technologies supporting high-priority DOE missions, specifically electrometallurgical treatment of DOE spent fuels for safe storage and ultimate disposition.

DOE is responsible for approximately 2,700 metric tons of spent nuclear fuel discharged from DOE reactors and in storage at several DOE sites. A standard, cost-effective means for treating this spent fuel for ultimate disposal is needed, and the electrometallurgical treatment process being developed at ANL, which allows treatment of various fuels by one common method, appears to best meet these requirements. This process produces two common high-level waste forms and offers significant cost savings due to commonality of process equipment and consolidation of waste forms. The process has the potential to treat up to 90 percent of DOE's spent nuclear fuel inventory.

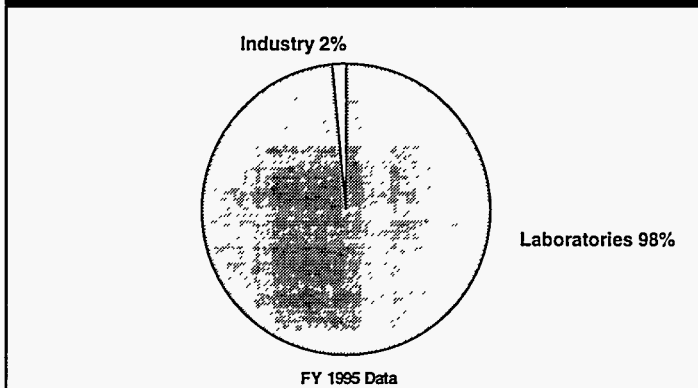
The electrometallurgical technology R&D program supports the following activities:

- Continued development of high-throughput electrorefiner to support conditioning of EBR-II fuel and blanket elements
- Continued R&D for treatment of other DOE spent fuel, such as N-reactor fuel and Molten Salt Reactor Experiment (MSRE) fuel, eliminating a current storage safety problem
- Waste treatment R&D and waste form qualification

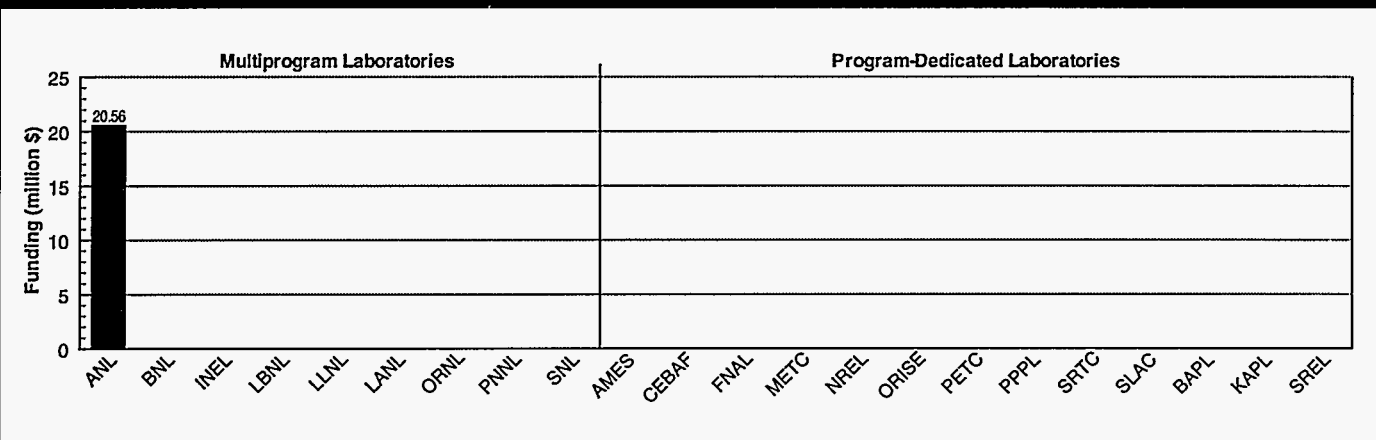
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



University Nuclear Science and Reactor Support

Department of Energy Program

Program: Nuclear Energy
Office: Science and Technology
Element: University Nuclear Science and Reactor Support
B&R Code: AF40

Laboratory Complex

Principal Laboratories: INEL
Contributing Laboratories: None
Participating Laboratories: ANL, ORNL

Mission Activity Description

The University Nuclear Science and Reactor Support activity provides funding for educational and research grants to help maintain a stable human resource base in the nuclear sciences. The activity also provides funding towards maintaining university reactors used for scientific research, education, and training. The nuclear sciences are an important contributor to the expanding environmental restoration, health, medicine, and research areas as well as to traditional nuclear energy areas. Specific elements of the activity include the following:

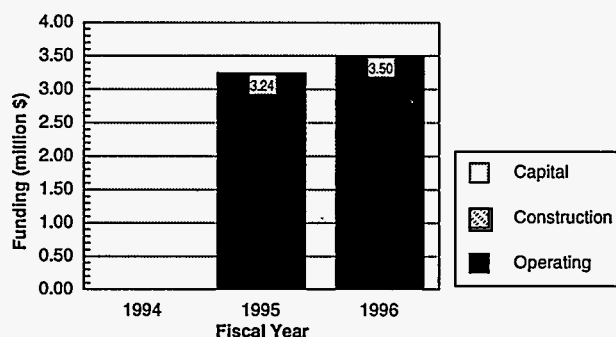
Reactor Fuel Assistance HEU/LEU Conversion—Supports fabrication of fuels for university research reactors and for the conversion of those reactors currently using highly enriched uranium (HEU) to lower enrichment fuels.

University Reactor Sharing—Provides grants that enable universities to make their reactors, ancillary facilities, and staff available to faculty and students from other academic institutions where such facilities do not exist. Under this program, educational tours of the facility are given, classes held, and individual research projects supported. Twenty-eight universities participate in the program.

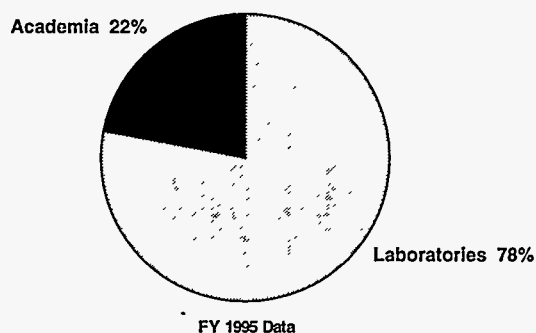
Utilities Matching Grant—Provides matching grants to 17 universities to support undergraduate and graduate education. Funds are matched by contributions from 12 utilities and are used for improving curricula, expanding experimental capabilities, undergraduate scholarships, and research by graduate students.

Reactor Safety Maintenance—Provides funds to upgrade the safety of university research reactors. The university reactors were constructed in the 1950s and 1960s, and many of these facilities, while operating very safely, are nevertheless not using state-of-the-art equipment that would improve both their safety and operational capabilities.

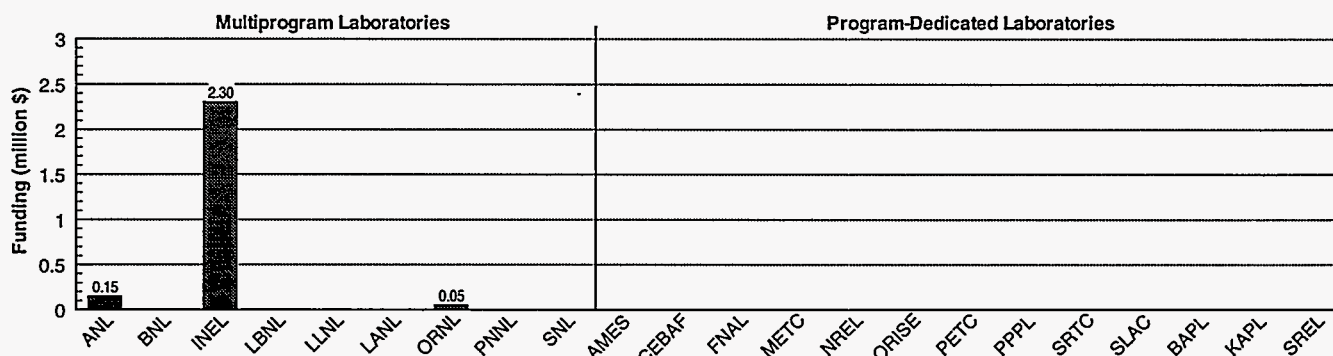
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Soviet-Designed Reactor Safety

Department of Energy Program

Program: Nuclear Energy
 Office: Science and Technology
 Element: International Nuclear Safety
 B&R Code: AF15

Laboratory Complex

Principal Laboratories: PNNL, BNL
 Contributing Laboratories: None
 Participating Laboratories: ANL

Mission Activity Description

The Soviet-Designed Reactor Safety activity is designed to reduce threats to nuclear safety and the environment posed by the operation of aging facilities in the former Soviet Union and Central and Eastern Europe. The program also conducts activities related to the safety of the Chernobyl nuclear powerplant. These activities are conducted consistent with guidance and policies established by the U.S. Department of State, the Agency for International Development, and the Nuclear Regulatory Commission. Activities include the following:

Management and Operational Safety Improvements—Improve the capabilities of nuclear powerplant operators to establish sound operational procedures and to develop methods for responding to operational abnormalities.

Engineering and Technology Upgrades—Improve the physical condition of the plants, particularly their safety systems.

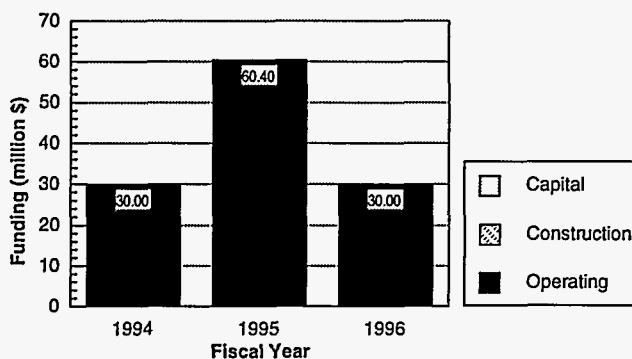
Plant Safety Evaluations—Provide professionals involved in the design, operation, and regulation of nuclear powerplants with the techniques and expertise required to conduct safety analyses that are consistent with Western practices.

Nuclear Safety Legislative and Regulatory Support—Provide assistance to host countries in developing the domestic liability legislation needed to enable a broader involvement of U.S. private industry and establish a strong, independent regulatory authority.

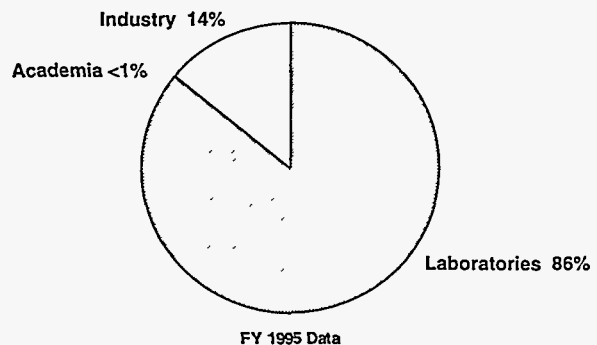
Chernobyl Initiatives—Provide short-term safety upgrades (for example, fire safety equipment) at the Chernobyl nuclear powerplant, and assist the Ukraine in its shutdown of the Chernobyl nuclear powerplant.

Exports of U.S. Nuclear Goods and Services—Promote international nuclear safety, and assist the U.S. nuclear industry in commercial exports. Specific objectives to meet these goals include the following: Support international organizations and specific countries' nuclear infrastructures in achieving increased nuclear safety; organize, promote, and conduct trade missions and export-related workshops.

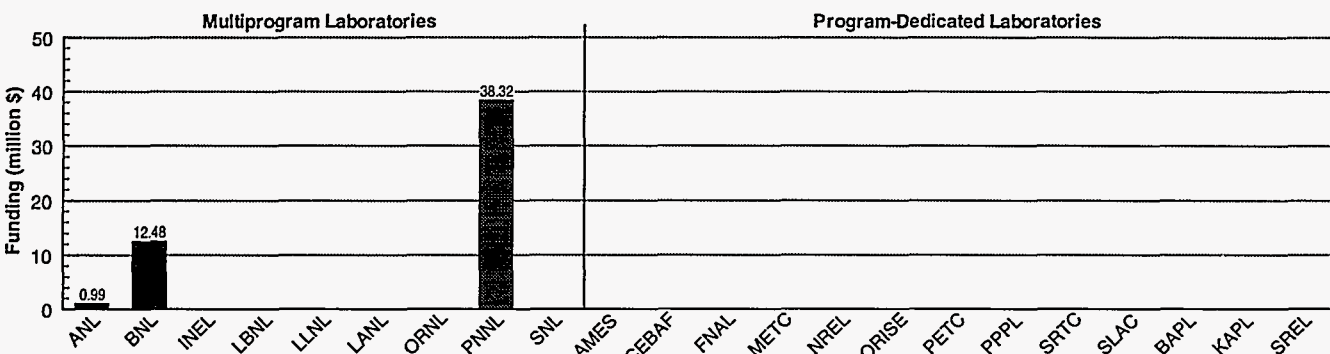
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Facilities and Termination Costs

Department of Energy Program

Program: Nuclear Energy
 Office: Science and Technology
 Element: Facilities
 B&R Code: AF80, AF85, AF89, AF95, AF99

Laboratory Complex

Principal Laboratories: ANL
 Contributing Laboratories: None
 Participating Laboratories: INEL, ORNL

Mission Activity Description

The Facilities and Termination Costs activity supports facilities and landlord activities including test reactor area (TRA) landlord, Advanced test reactor (ATR) fusion irradiations, Oak Ridge landlord, TRA hot cells, and termination costs. (In FY 1996 and FY 1997 funding previously provided in the Facilities account is included in the termination costs decision unit.)

Test Reactor Area Landlord Activities—Test reactor area landlord activities include operating support equipment procurement; general plant projects and line item capital projects to ensure the safety and reliability of TRA site facilities; correction of TRA environment, safety, and health deficiencies. TRA Landlord supports the DOE isotope production program and the Advanced Test Reactor, which is vital to the Naval Nuclear Propulsion Program.

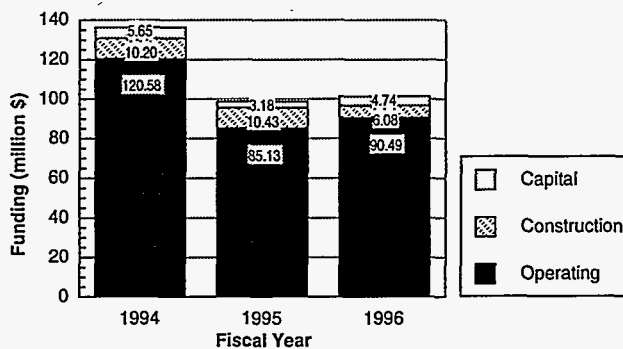
Advanced Test Reactor Fusion Irradiations—ATR fusion irradiation activities provide for the design, fabrication, and installation of an irradiation test vehicle in the ATR that will be utilized to test advanced materials for the DOE/Monbusho Fusion Energy program.

Oak Ridge Landlord Activities—Oak Ridge landlord activities provide for centralized Oak Ridge Operations Office infrastructure requirements and general operating costs for those activities outside plant fences of ORNL, the Y-12 Plant, and the K-25 Plant.

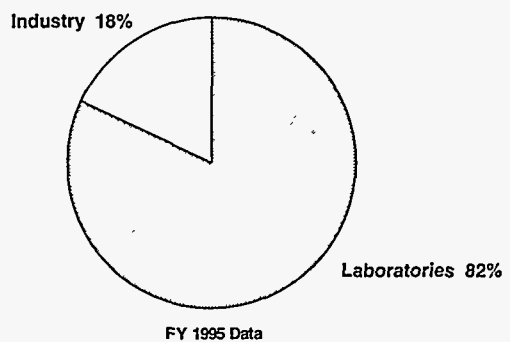
Test Reactor Area Hot Cell—The TRA hot cells at INEL support production of isotopes for medical and industrial applications, fusion materials irradiation experiments, and other DOE programs.

Termination Costs—Termination costs provides for termination of the Gas-Turbine Modular Helium Reactor Program in fiscal year 1996 consistent with the National Academy of Sciences report and the placement of unneeded Office of Nuclear Energy, Science and Technology facilities into an industrially and radiologically safe shutdown condition.

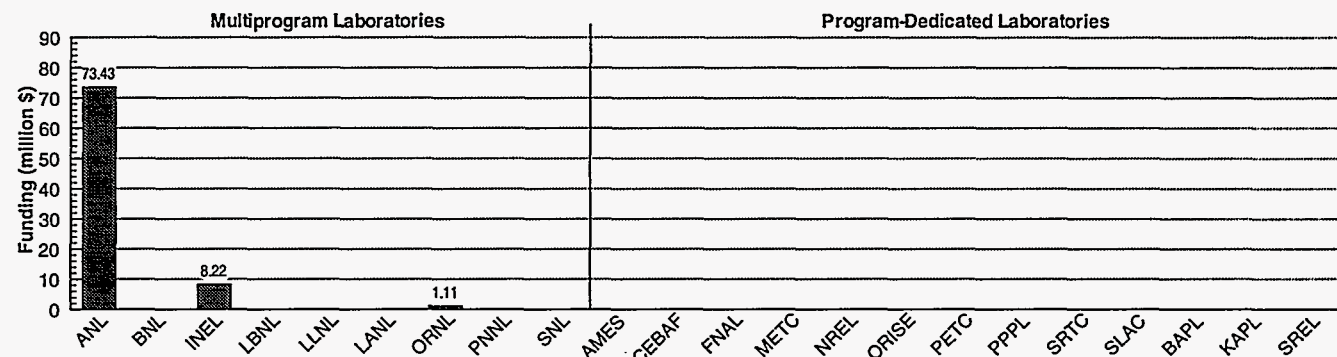
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Nuclear Isotope Support

Department of Energy Program

Program: Nuclear Energy
Office: Isotope Production and Distribution
Element: Isotope Support
B&R Code: ST01, ST02, ST03, ST04, ST05, ST06, ST07, ST08

Laboratory Complex

Principal Laboratories: ORNL, SNL
Contributing Laboratories: LANL
Participating Laboratories: BNL, INEL, LLNL, ORISE, PNNL

Mission Activity Description

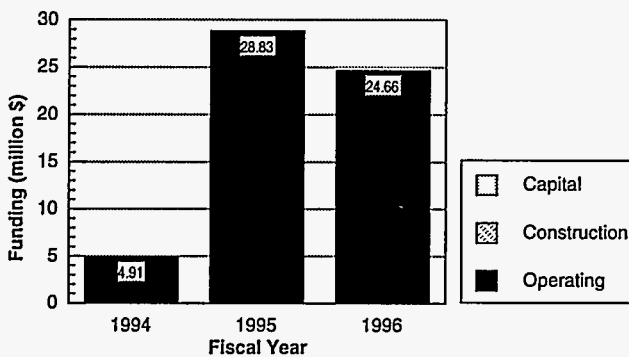
Many uses for isotopes have emerged over the past generation as an adjunct of nuclear research, defense, and power development programs. The very existence of certain industries is dependent on the isotopes produced by the Department. Some examples include: americium-241 for smoke detectors; technetium-99m, thallium-201, and fluorine-18 for medical imaging, yttrium-90 for medical therapeutic applications; iridium-192 for nondestructive testing; and cobalt-60 for sterilization.

The Isotope Program has two primary missions. The first is to produce and distribute certain low-volume radioisotopes and enriched stable isotopes for research and development, medical diagnoses and therapy, and other applications that are in the national interest. The second mission is to produce and distribute high-volume radioisotopes and enriched stable isotopes that have profit potential for medical, industrial, and other useful applications on a businesslike basis, by providing radioactive and stable isotope products and associated services to a widely varied domestic and international market.

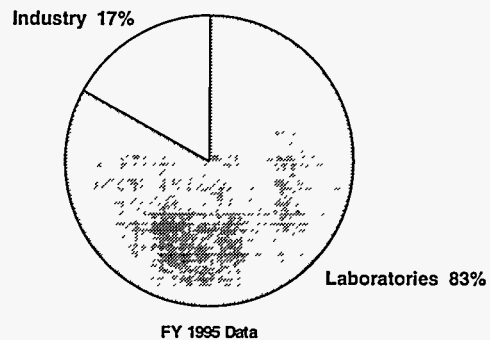
The Department engages in isotope production only when (1) there is no existing U.S. private sector production capability; (2) unique Government facilities are needed; or (3) other productive industrial capacity is insufficient to meet pressing U.S. needs.

A significant ongoing Isotope Program initiative is establishment of a U.S. capability for production of molybdenum-99 (Mo-99) and related medical isotopes. Mo-99 is a precursor of technetium-99, which is used in over 36,000 medical procedures each day in the United States alone. At present, there is no domestic source for Mo-99 and other related medical isotopes that are essential to U.S. health care and research.

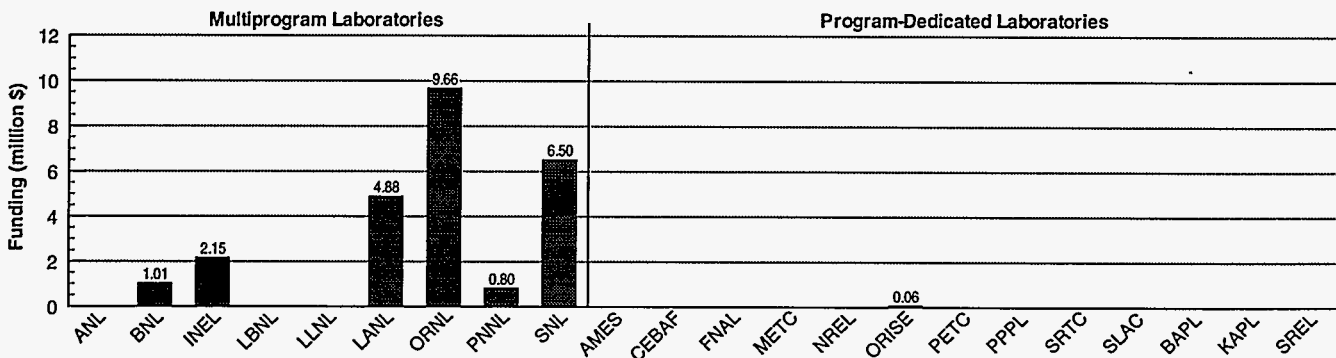
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Nuclear Energy Uranium Enrichment Technology Partnerships

Department of Energy Program

Program: Nuclear Energy
 Office: Uranium Programs
 Element: Technology Partnerships
 B&R Code: CD1009

Laboratory Complex

Principal Laboratories: ORNL
 Contributing Laboratories: None
 Participating Laboratories: None

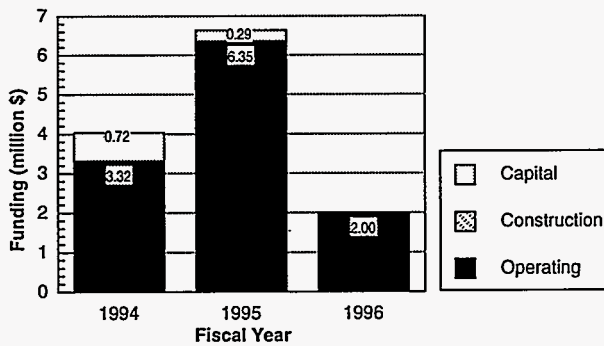
Mission Activity Description

The transfer of DOE-developed derivative uranium enrichment membrane and centrifuge technologies to U.S. industry for nonuranium enrichment applications is a mission of the uranium programs of the Office of Nuclear Energy, Science and Technology. This transfer is facilitated through partnerships between U.S. industry and the DOE laboratory on a 50-50 cost sharing basis (as a minimum) using cooperative research and development agreements (CRADAs) as a mechanism. In the CRADA agreement, the Federal funding only funds the DOE laboratory, and the non-Federal funds normally fund the industry partners' part of the joint work statement. If the case would arise, the private partner can fund the DOE laboratory to accomplish specific CRADA-related tasks through a Funds-in CRADA mechanism.

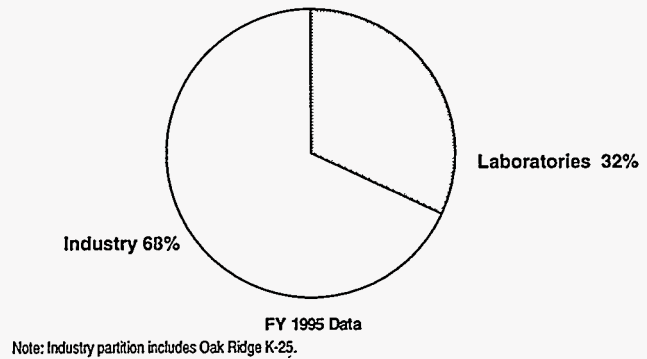
The Uranium Programs are expanding their transfer activities and the number of CRADAs because of increased U.S. industry interest and the significant number of commercial applications and fields of use that offer significant public and private benefits. Uses include such areas as cleanup of radioactive hazardous and toxic contaminants and volatile organic compounds from ground water and industrial processes. Applications in the health field include removal of infectious diseases, bacteria, and virus from air, water, blood, and other human consumables.

The technical goals of the transfer of the DOE-developed technology are to improve U.S. industrial competitiveness through introduction of new products and processes, and to enhance U.S. economic growth and benefits, such as creation of new jobs and increased industrial annual sales. Benefits to the U.S. taxpayer will be realized through licensing royalty payments to the U.S. Treasury.

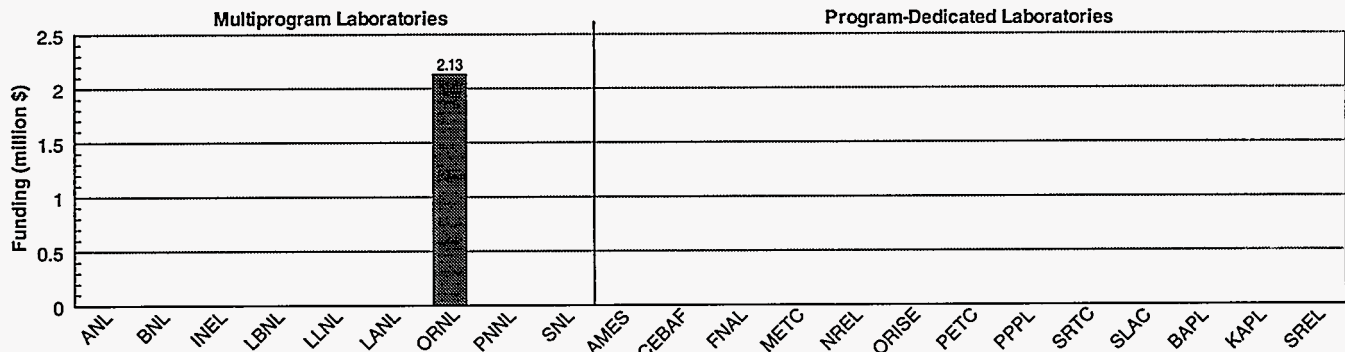
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Highly Enriched Uranium (HEU) Transparency Measures

Department of Energy Program

Program: Nuclear Energy
Office: International Nuclear Safety
Element: Transparency Measures
B&R Code: CD1013

Laboratory Complex

Principal Laboratories: LLNL
Contributing Laboratories: None
Participating Laboratories: BNL, LANL, PNNL, SNL

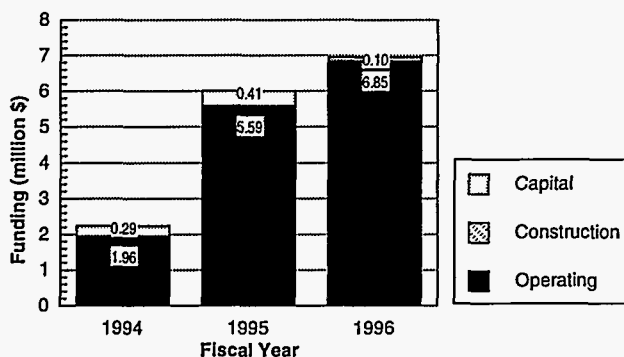
Mission Activity Description

In February 1993, the governments of the United States and the Russian Federation signed an agreement for the U.S. purchase of low enriched uranium (LEU) derived from high enriched uranium (HEU) removed from dismantled Russian nuclear weapons, estimated to have a value of \$11.9 billion. Among other things, the purchase agreement calls for the establishment of transparency measures that will provide both parties with confidence that the nuclear nonproliferation objectives of the Agreement are being met.

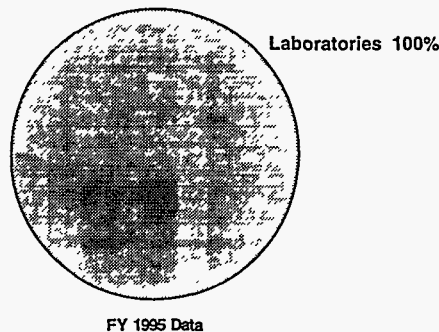
The DOE Office of Nuclear Energy, Science and Technology is responsible for implementing the transparency activities associated with the purchase. Activities include a combination of permanent and special monitoring visits by government and national laboratory experts who have been trained to monitor Russian facilities. Nonintrusive instrumentation and techniques will be developed to improve monitoring credibility. The program will also help to coordinate and provide oversight for the Russian monitoring activities in the United States and will provide assistance to U.S. facilities that are subject to Russian monitoring activities. Assurance that the LEU delivered to the United States under the agreement is fabricated into fuel for commercial nuclear reactors will be accomplished through a combination of declarations by the United States and access by the Russian monitors to the Portsmouth Gaseous Diffusion Plant and the U.S. nuclear reactor fuel fabricators.

The program supports the joint U.S.-Russian Transparency Review Committee (TRC) that develops transparency policy and negotiates the details of monitoring access to facilities, processing, and data, and the possible use of monitoring instrumentation to provide independent measurements. The U.S. participation in the TRC is led by the DOE Office of Nonproliferation and National Security. The Ministry of Atomic Energy (MINATOM) is the entity in the Russian Federation responsible for negotiating all agreements and activities related to HEU Transparency. The Transparency Program managed by the DOE Office of Nuclear Energy, Science and Technology, Office of International Nuclear Safety, implements the transparency activities, develops advanced techniques to provide enhanced but less intrusive monitoring activities, estimates the credibility of procedures, and coordinates the field operations.

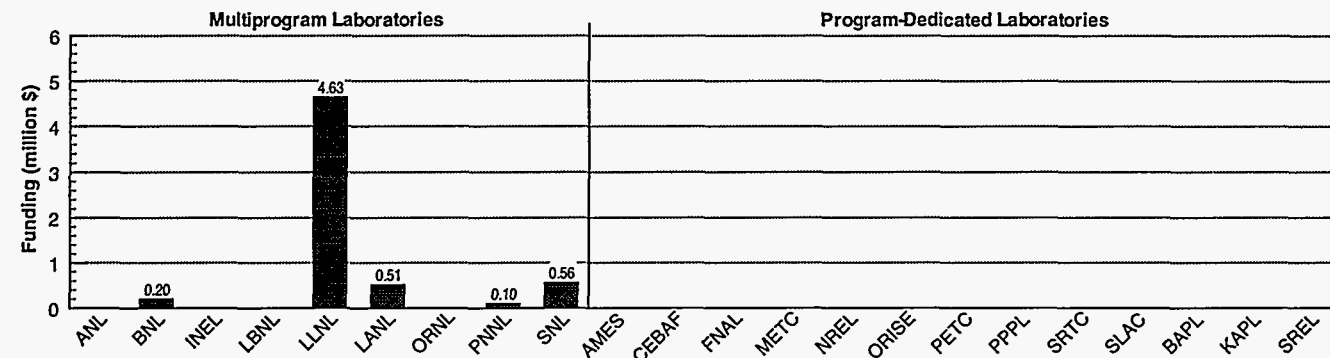
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Solar Building Technologies

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Building Technologies
Element: Building Equipment
B&R Code: EB21

Laboratory Complex

Principal Laboratories: NREL
Contributing Laboratories: None
Participating Laboratories: PNNL

Mission Activity Description

The Solar Building Technology activity works to provide cost-effective use of solar energy for space conditioning, hot water, and electric generation. The goal is to increase the utilization of solar technologies through partnership with industry and end-users. The activity covers a variety of integrated research and deployment activities addressing photovoltaic buildings research, advanced concepts, reliability and maintainability issues, rating and certification procedures, and market conditioning. These include:

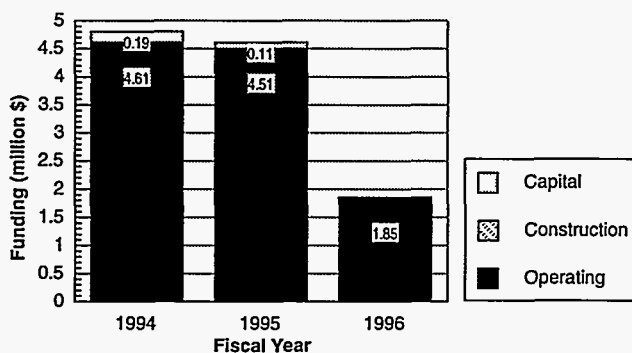
Research

- **Building Integrated Photovoltaics**—Innovative integrated heat, ventilating, and air-conditioning systems, and photovoltaic windows and roof membranes.
- **Reliability/Maintainability**—Technical issues affecting sustained performance of active solar systems.
- **Advanced Concepts**—Advanced materials, components, system design, and manufacturing concepts.

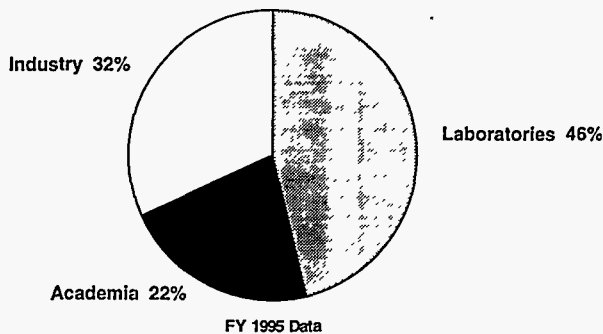
Ratings and Certification—Development of analytical testing methodologies to support industry efforts in establishing voluntary rating and certification procedures for implementation by the Solar Rating and Certification Corporation.

Market Conditioning—Technology deployment efforts supporting specific needs identified by utilities and the solar industry.

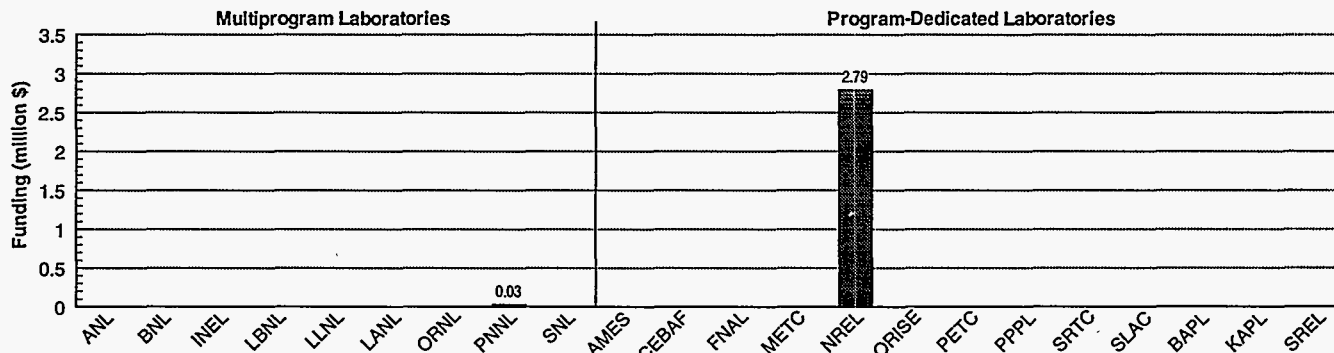
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Photovoltaic Energy Systems

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Utility Technologies
Element: Solar Energy Conversion
B&R Code: EB22

Laboratory Complex

Principal Laboratories: NREL
Contributing Laboratories: SNL
Participating Laboratories: BNL

Mission Activity Description

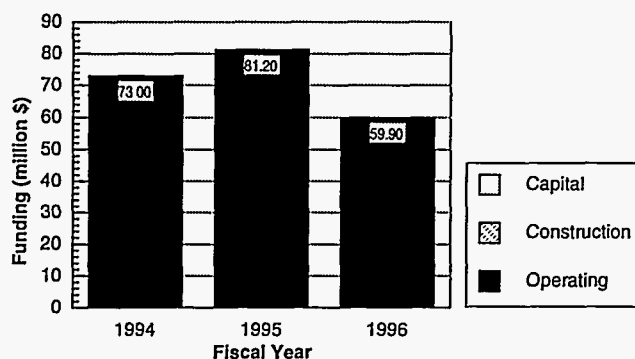
The Photovoltaic Energy Systems activity represents a balanced effort in research (fundamental research, advanced materials and devices, and collector research and systems development), manufacturing engineering, and market development. Representative technologies include silicon wafers of single-crystal or polycrystalline silicon; thin-film materials, such as amorphous silicon, copper indium diselenide, cadmium telluride, polycrystalline silicon, and gallium arsenide-based materials; and high-efficiency, multijunction cells for concentrator or flat-plate arrays, such as gallium arsenide alloys.

Research—Fundamental research activities continue to resolve issues concerned with advanced (post-2000) competitive energy technologies through measurements and performance evaluation activities at universities and Federal laboratories. Advanced materials and devices work continues cost-shared activities with industry to improve device efficiency and stability, particularly for large-area, thin-film deposition systems. High-efficiency research activities investigate multibandgap, multijunction monolithic devices that show promise for achieving concentrator cell conversion efficiency above 35 percent. Module and system reliability research supports environmental testing of photovoltaic modules and systems to improve their operational life.

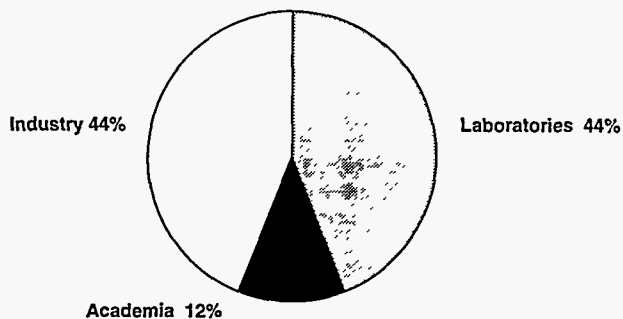
Manufacturing Engineering—Government and industry jointly participate in advancing manufacturing processes and reducing manufacturing costs. The project is expected to reduce the cost of photovoltaically produced electricity by more than a factor of 2, to \$0.12 per kilowatthour, in the near term and more than double U.S. industry's manufacturing capacity over that projected without this activity.

Market Development—Market development activities, such as Building Opportunities in the U.S. for Photovoltaics (PV) and the Utilities PV Group, are cost-shared efforts with contractors and utilities to increase the use of photovoltaic systems in buildings and utility applications, respectively.

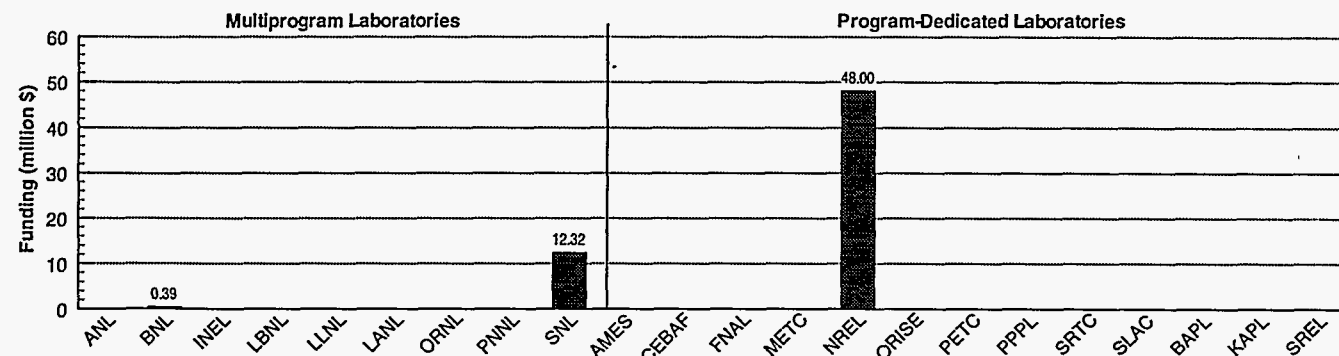
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Solar Thermal Energy Systems

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
 Office: Utility Technologies
 Element: Solar Energy Conversion
 B&R Code: EB23

Laboratory Complex

Principal Laboratories: SNL
 Contributing Laboratories: NREL
 Participating Laboratories: None

Mission Activity Description

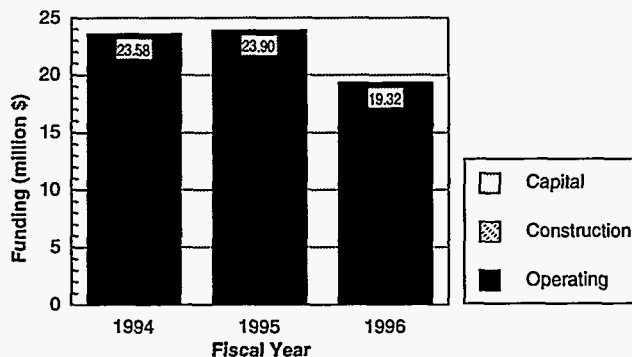
Solar thermal electric (STE) technology works by concentrating large amounts of sunlight onto a smaller surface area to achieve high temperatures, which are then converted to electricity. Currently, there are three STE technologies: power towers, dish/engines, and parabolic troughs.

The mission of DOE's STE activity is to work with manufacturers, developers, and users of STE technology to (1) develop reliable and efficient STE systems that will generate economically competitive power that can reduce our Nation's dependence on foreign energy sources; and (2) proactively support the development of these technologies in order to penetrate markets with new energy applications, thus creating new jobs and business opportunities in the United States and abroad.

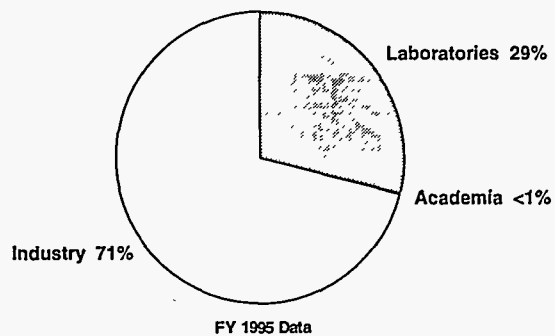
The STE Program, in conjunction with the industry and user communities, has developed a leveraged cost-shared program to support the technology research and development necessary to achieve electric generation costs in a competitive range (less than 10 cents per kilowatthour). Projects include:

- 10 MWe Solar Two Power Tower
- Solar disk/engine systems
- Solar Manufacturing Initiative
- Solar thermal electric applied research and development
- Manufacturing and technical support

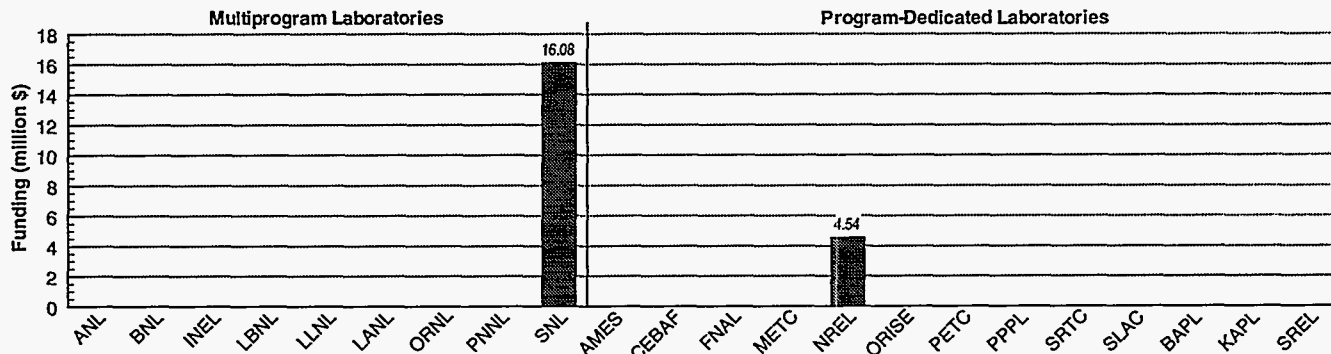
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Biofuels Energy Systems

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Industrial, Utility, and Transportation Technologies
Element: Biotechnology, Biomass Power, and Biofuels
B&R Code: EB24

Laboratory Complex

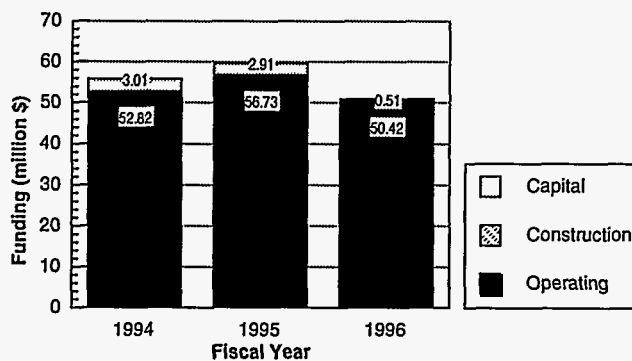
Principal Laboratories: NREL
Contributing Laboratories: ORNL
Participating Laboratories: ANL, INEL, PNNL, SNL

Mission Activity Description

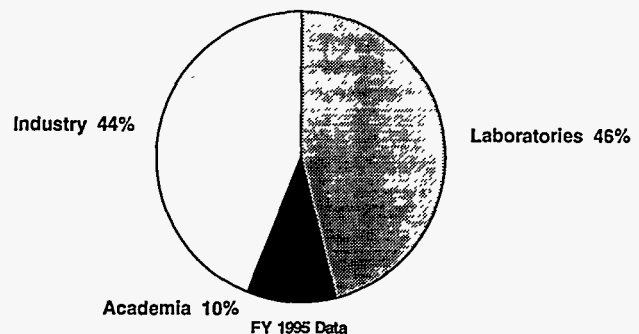
The Biofuels Energy Systems activity provides the technology base necessary for developing cost-competitive systems that can produce energy from biomass. Biomass feedstocks include agricultural residues and forestry wastes, such as rice straw/husks and sawdust, municipal solid waste, and trees and grasses grown specifically for their energy content. Biomass energy can provide products for three major world markets—electric power generation, transportation fuels, and chemical production—and has the potential to provide approximately 33 percent of the total U.S. energy needs in these markets. Biomass energy systems can also provide substantial environmental benefits. Because bioenergy crops absorb carbon when they are growing, their use in vehicles or for electricity production results in very little net carbon release. When these fuels are used to displace traditional fossil fuels (such as coal for electricity generation), significant emission reductions of the oxides of sulfur and nitrogen can also be achieved. In addition, because biomass is domestically produced and is renewable, it offers significant opportunities for job creation, rural economic development, and alternative crop production opportunities for farmers (which can result in a further reduction of Federal agricultural subsidy payments).

The Biofuels Energy Systems activity has five emphases: (1) to develop bioenergy crops and production methods that generate competitively priced feedstocks for use in power conversion and liquid-fuel markets; (2) to develop and deploy biomass conversion technologies that produce power and biofuels; (3) to modify and deploy technologies for use with biomass-derived fuels; (4) to demonstrate biofuel technology; and (5) to assist commercialization and promote market penetration of these technologies.

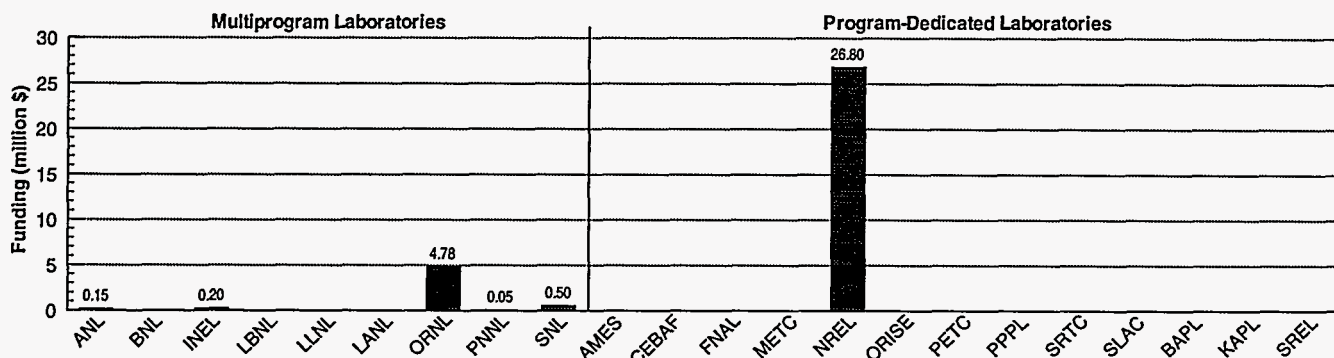
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Wind Energy Systems

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Utility Technologies
Element: Renewable Energy Conversion
B&R Code: EB25

Laboratory Complex

Principal Laboratories: NREL
Contributing Laboratories: None
Participating Laboratories: PNNL, SNL

Mission Activity Description

The Wind Energy Systems activity focuses on advancing wind energy as a cost-effective renewable and pollution-free electric power generation option, and thus directly supports the mission of DOE to achieve diversity in energy sources, a more productive economy, and improved environmental quality for the Nation. Over the last decade, wind technology has improved such that the cost of generating electricity at sites with good windspeeds has been reduced by a factor of 3. The Wind Energy Systems activity supports industry's efforts to further bring down wind energy costs and surmount market barriers, leading to an expected tenfold expansion of exploitable U.S. wind resources, through activities in the following areas:

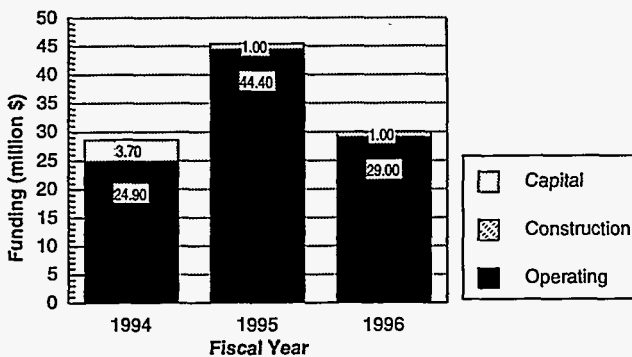
Applied Research—Applied research in wind characterization, aerodynamics, structural dynamics and fatigue, materials, and system dynamics and controls that produce technology breakthroughs contributing to lower wind energy costs. In addition, applied research includes activities to address critical issues for the wind industry, such as avian interactions.

Turbine Research—Cost-shared projects with industry to apply innovative technologies to full-scale wind turbine systems, components, and manufacturing.

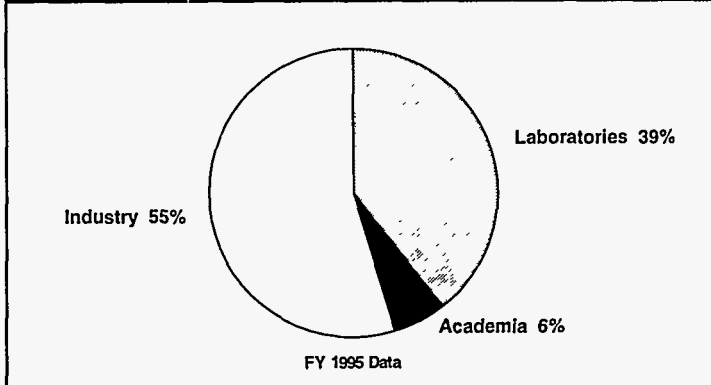
Cooperative Research and Testing—Technology assistance to industry and wind energy users, primarily through the U.S. National Wind Technology Center (NWTC, an international center of excellence for wind energy research, testing, and technical support. NWTC activities include onsite testing of advanced technology turbine prototypes and wind turbine blades, dynamometer testing of turbine drive trains, and hardware certification testing.

Technology Deployment—Responses to market barriers through activities such as interaction with Federal, State, and local regulatory processes, and projects that expand user experience with wind energy. The National Wind Coordinating Committee, a broad-based stakeholder collaborative, serves as a focal point for technology deployment activities.

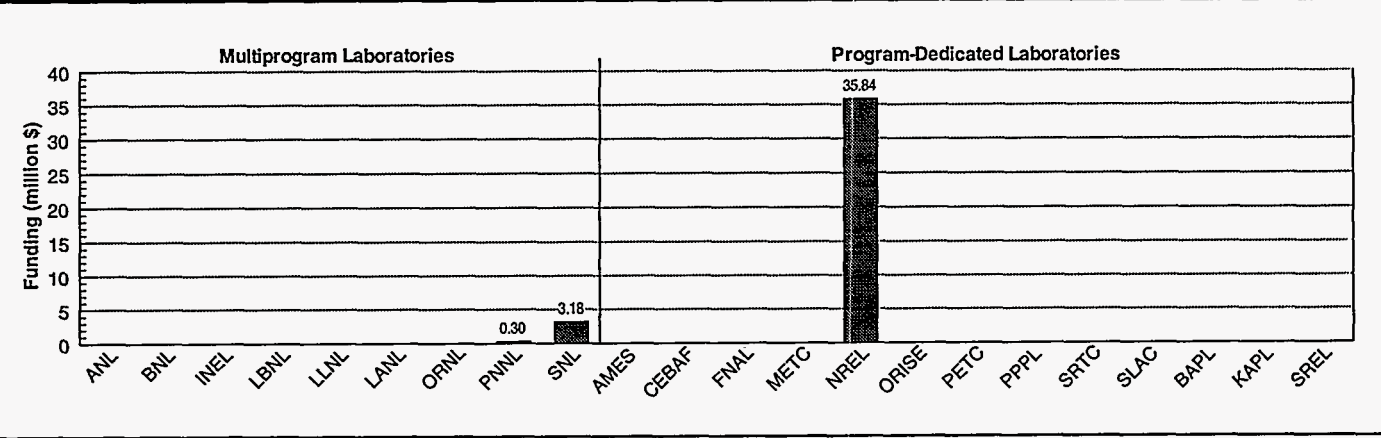
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Solar International

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
 Office: Technical and Financial Assistance
 Element: Technical Assistance
 B&R Code: EB27

Laboratory Complex

Principal Laboratories: NREL, SNL
 Contributing Laboratories: None
 Participating Laboratories: None

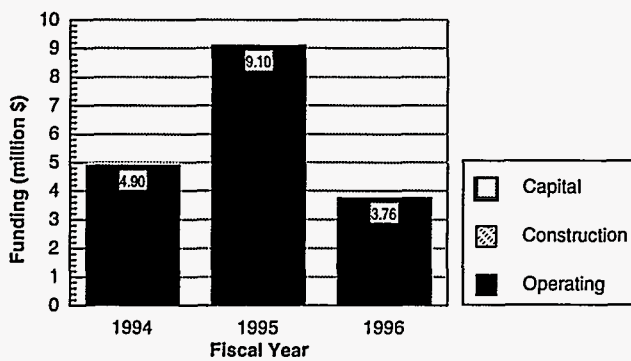
Mission Activity Description

The Solar International programs promote the export of U.S. renewable energy technologies worldwide. International market development is needed to strengthen support for U.S. renewable energy products and services in rapidly expanding global markets. Such efforts are required to gain maximum benefit from renewable energy markets that exist today, to counter the government efforts of foreign competitors, and to retain a preeminent role for the United States in the energy technologies of the future. Toward this end, the Solar International programs promote the reduction of trade barriers, the development of joint efforts with host country energy industries, the demonstration of the benefits of U.S. technology, and the collaborative resolution of rural electrification needs worldwide.

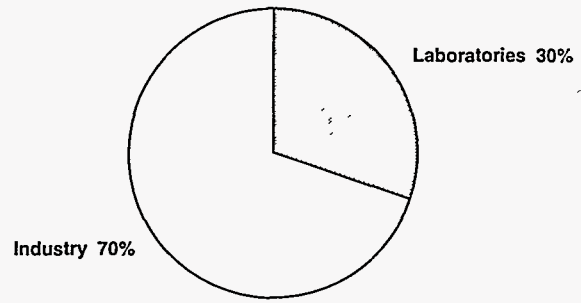
These programs play a critical role in helping U.S. manufacturers capitalize on the rapidly expanding international market for renewable energy technologies, which could reach \$100 billion to \$150 billion in the lesser developed countries alone. By increasing renewable energy exports, these programs create U.S. jobs, make U.S. businesses more competitive and reduce pollution from traditional energy sources.

One of these programs, CORECT (Committee on Renewable Energy Commerce and Trade) develops collaborative strategies in conjunction with the other 14 Federal agency members to best allocate limited Federal resources. Currently 175 promising renewable energy projects have been identified in Latin America which are being shepherded through the various stages of project development. Another program, the Americas 21st Century Program implements the CORECT strategies in Latin America and the Caribbean to deploy U.S. technologies through cost-shared joint ventures with public and private sectors. The U.S. Initiative on Joint Implementation encourages public and private partnerships that use U.S. renewable energy technologies to reduce greenhouse gas emissions.

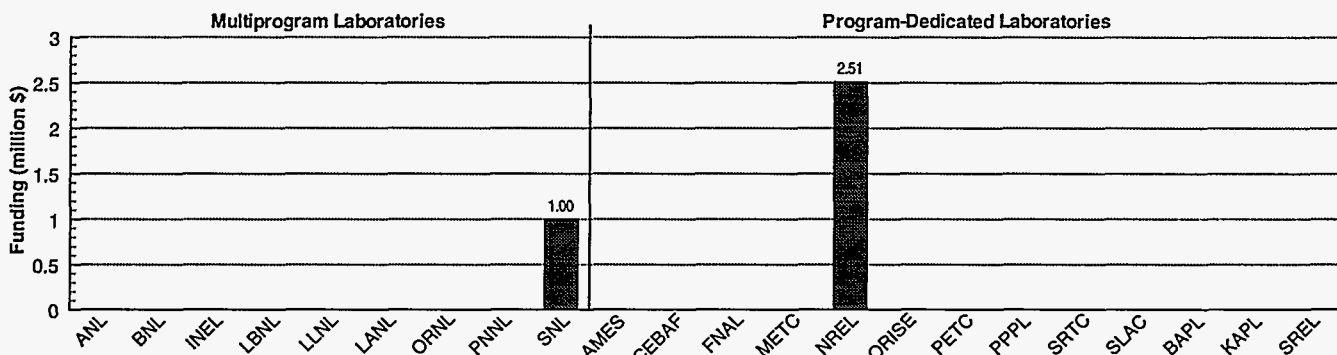
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Solar Technology Transfer

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Technical and Financial Assistance
Element: Technical Assistance
B&R Code: EB28

Laboratory Complex

Principal Laboratories: NREL
Contributing Laboratories: None
Participating Laboratories: None

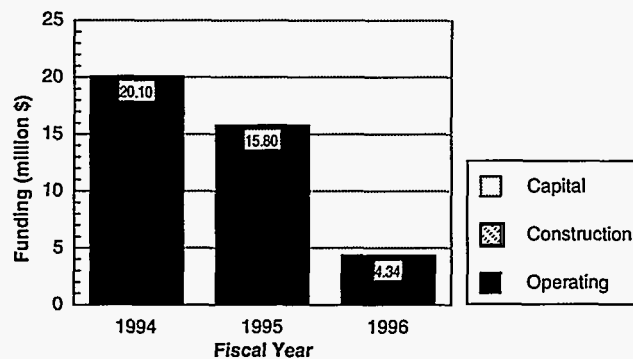
Mission Activity Description

The Solar Technology Transfer activity employs a two-pronged approach that addresses the specific problems that slow the acceptance of new and existing renewable energy technologies in the marketplace. First, is the lack of credible up-to-date information on the technologies and their various applications; and, second, is the need to "pull" rather than "push" emerging technological advances into the marketplace.

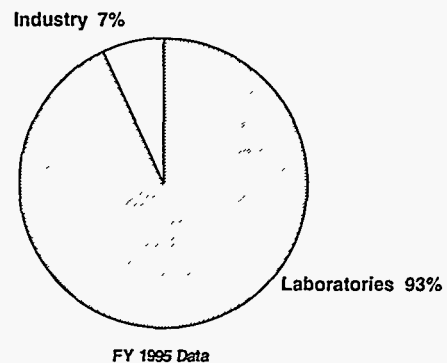
The Information and Communications subprogram reduces market barriers by directly educating consumers. This subprogram provides accurate and unbiased information on energy efficiency and renewable energy technologies so that potential customers make informed decisions in the marketplace that result in an increase in the adoption of renewable energy technologies and energy-efficiency practices. This Program also raises the overall awareness of the state-of-the-art technologies through the operation of both a toll-free telephone service and the more in-depth dissemination of brochures, exhibits, factsheets and tailored responses to specific energy questions.

The Commercialization Ventures subprogram facilitates the entrance of newly emerging technologies into the marketplace through the provision of financial and nonfinancial assistance. The Program leverages private sector financing and assists smaller emerging firms with the preparation of business plans. It supports the Department's commercialization objective, which is to accelerate the rate at which viable new renewable energy technologies and efficiency practices are drawn into the domestic and international markets.

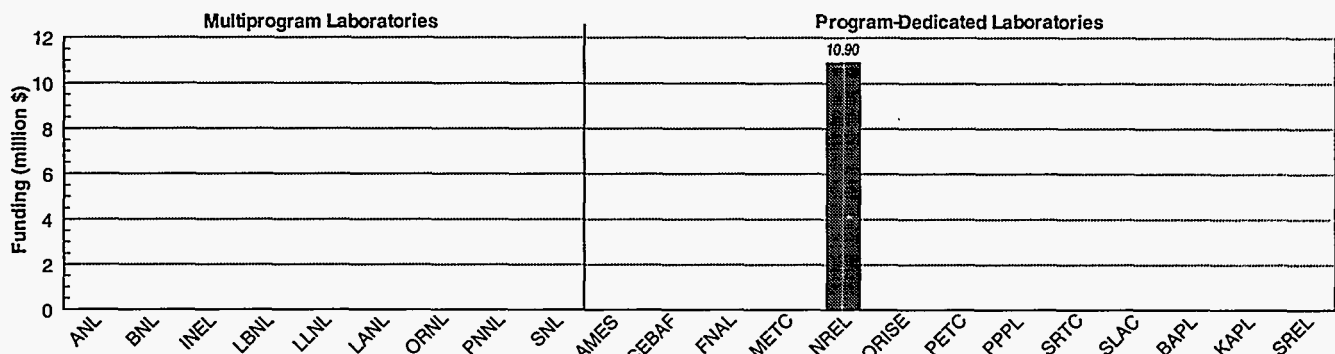
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Resource Assessment

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Utility Technologies
Element: Solar Energy Conversion
B&R Code: EB35

Laboratory Complex

Principal Laboratories: NREL
Contributing Laboratories: None
Participating Laboratories: ORNL

Mission Activity Description

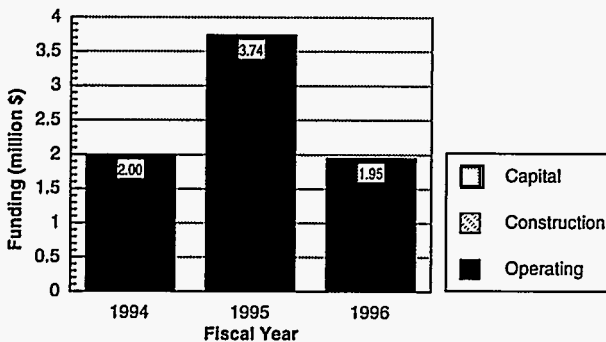
DOE's Resource Assessment activity supports the energy resources mission by developing databases, tools, and products about renewable energy resources (solar, wind, biomass, geothermal, and hydro) that allow planning, designing, and implementing renewable energy technologies. The overall long-term program goal is to improve information on the spatial extent and temporal characteristics of renewable resources, and to reduce the level of uncertainty in this information. This goal has been established because the quality of current resource information often is too limited to allow for adequate planning of the development and deployment of technologies. Because of the highly variable nature of renewable energy resources, uncertainties exist not only in our knowledge of the spatial extent of the resource, but also in how they might vary over the lifetime of a renewable energy system. These uncertainties still pose a significant barrier to the successful development of renewables.

Thus, in fulfilling the Resource Assessment Program's primary goal, several strategic approaches have been taken:

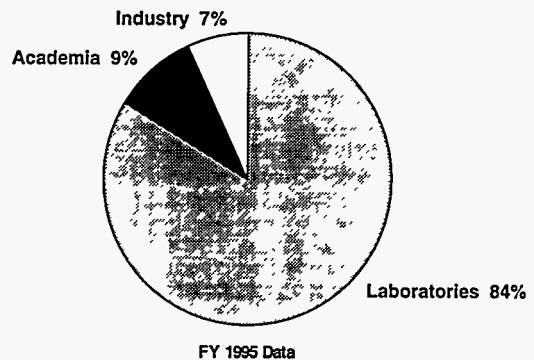
- The program develops hardware and software tools and analytical procedures that can be used by private industry and government planners to improve the assessment of renewable resources.
- The program supports long-term, continuous monitoring at strategic "benchmark" locations for wind and solar resources.
- The program provides a centralized location for assembling and disseminating national and international renewable energy resource information.

These actions benefit DOE in its long-term strategic planning by providing key information related to the potential market for various renewable technologies. This information also assists the U.S. renewable energy industry by removing critical barriers and speeding the successful deployment of its technologies, both domestically and internationally.

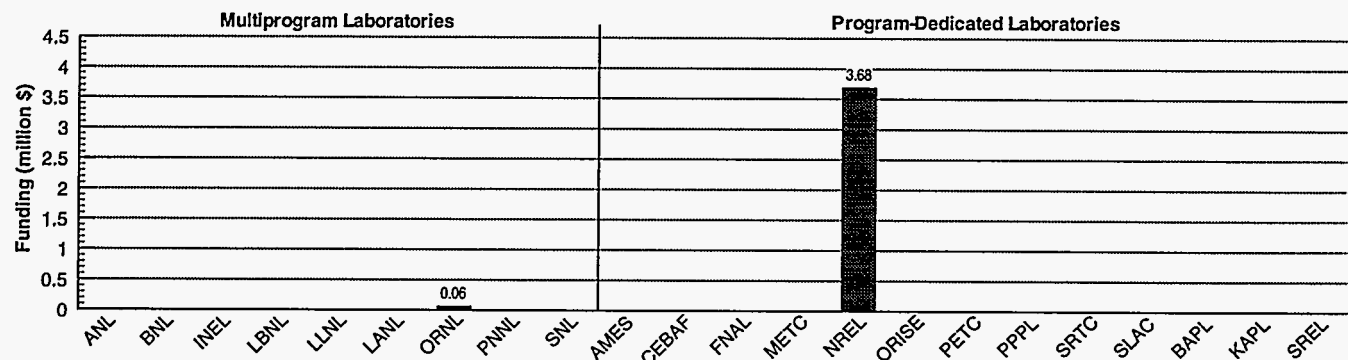
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Technical and Financial Assistance

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
 Office: Technical and Financial Assistance
 Element: State and Local Technical Assistance
 B&R Code: EF

Laboratory Complex

Principal Laboratories: NREL, ORNL, PNNL
 Contributing Laboratories: None
 Participating Laboratories: ANL

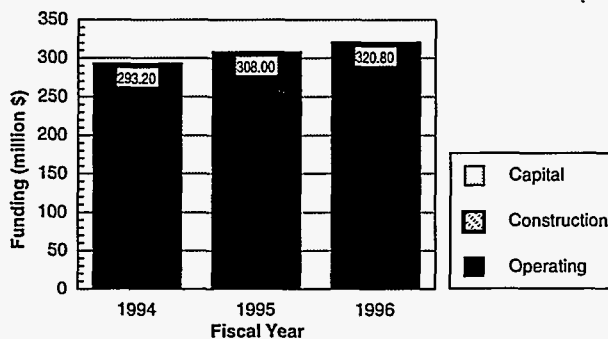
Mission Activity Description

The Office of Technical and Financial Assistance (OTFA) operates information, technical assistance, and financial incentive programs for States, local governments, nonprofit organizations, inventors, and individual consumers. These include grant programs and technical assistance that enable States and localities to deliver energy services to consumers in their jurisdictions and respond to energy emergencies; other programs assist in deployment of market-ready U.S. energy technologies, services, and products and help coordinate the wide array of Federal programs and activities involved in opening international markets to U.S. technologies. OTFA programs comprise two sets of key activities: State and Local Partnership Programs and Targeted Deployment Programs.

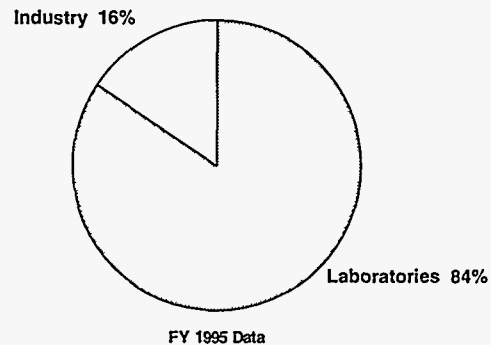
State and Local Partnership Programs—State and Local Partnership Programs key activities reflect the Nation's many diversities, address a broad spectrum of energy activities, and are characterized by a great deal of flexibility for States and local governments to identify and focus on their own needs and opportunities. These programs include the Weatherization Assistance Program, the State Energy Management Program, the Municipal Energy Management Program, and Program Direction.

Targeted Deployment Programs—Targeted Deployment Programs are more narrowly focused on specific markets, technologies, and/or stakeholders and potential users. Each program addresses a clearly defined market or clientele, a distinct market barrier, and/or a particular technology. These programs are made up of the Inventions and Innovation Program, International Market Development, the Information and Communications Program, and the programs funded from the Energy and Water accounts including Information and Communications, Commercialization Ventures, the Solar International Program, and the Regional Biomass Program.

Funding History

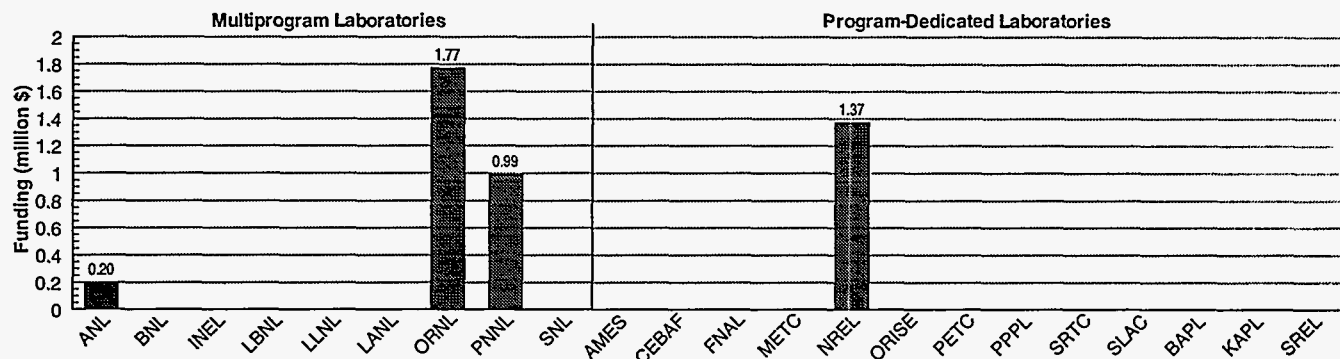


Laboratory-Academia-Industry Participation



Note: State and local partnership programs are not included here.

Fiscal Year 1995 Funding Profile



Geothermal Energy Systems

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Utility Technologies
Element: Renewable Energy Conversion
B&R Code: AM

Laboratory Complex

Principal Laboratories: LANL, SNL
Contributing Laboratories: None
Participating Laboratories: BNL, NREL, ORNL

Mission Activity Description

The Geothermal Energy Systems activity is a balanced program of research, technology development, and deployment aimed at reducing the life-cycle cost of electric power from geothermal resources and accelerating the direct use of geothermal heat, including heat pump technology. The program's overall goals are to reduce the operating cost of geothermal electric power facilities by 25 percent by the year 2000 and to reduce the life-cycle cost of new facilities by 30 percent by the year 2005. The five principal geothermal research and development areas are as follows:

Exploration Technology—Most known U.S. hydrothermal systems with obvious surface manifestations have been explored. Research in this area focuses on instruments and techniques to discover hidden hydrothermal systems and to explore the deep portions of known systems.

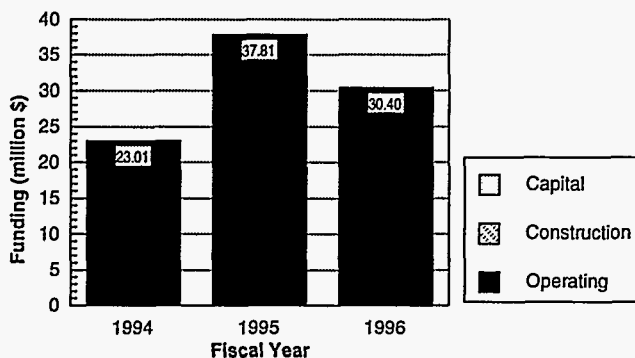
Drilling Technology—The drilling of wells accounts for 35 to 50 percent of the cost of generating electricity from geothermal resources. This technology development effort involves improved, less expensive drilling and completion equipment and methods for exploration and production.

Reservoir Technology—This research couples the development of advanced equipment and analytical methodologies with complex computer modeling to establish practical approaches for the identification, definition, and production of hydrothermal geothermal resources.

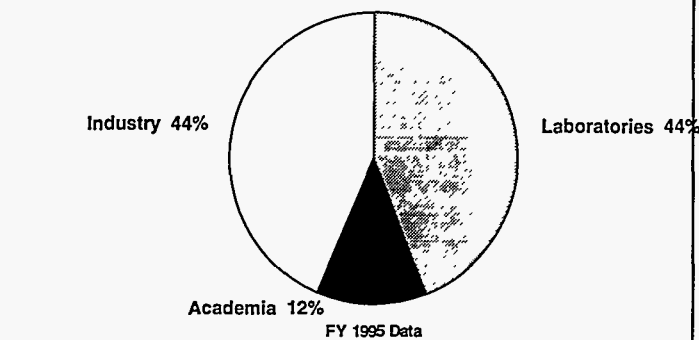
Conversion Technology—This research effort aims to reduce both capital and operating costs of systems that convert geothermal heat to electric power. Principal thrusts include innovative energy conversion concepts, improved cycle efficiency, advanced heat rejection systems, solid residue treatment processes, and low-cost materials resistant to elevated temperatures, corrosion, and scaling.

Environmental Technology—This category includes research, development, and deployment projects aimed at reducing greenhouse gas emissions. Geothermal heat pumps offer a unique opportunity for achieving significant reductions in such emissions.

Funding History

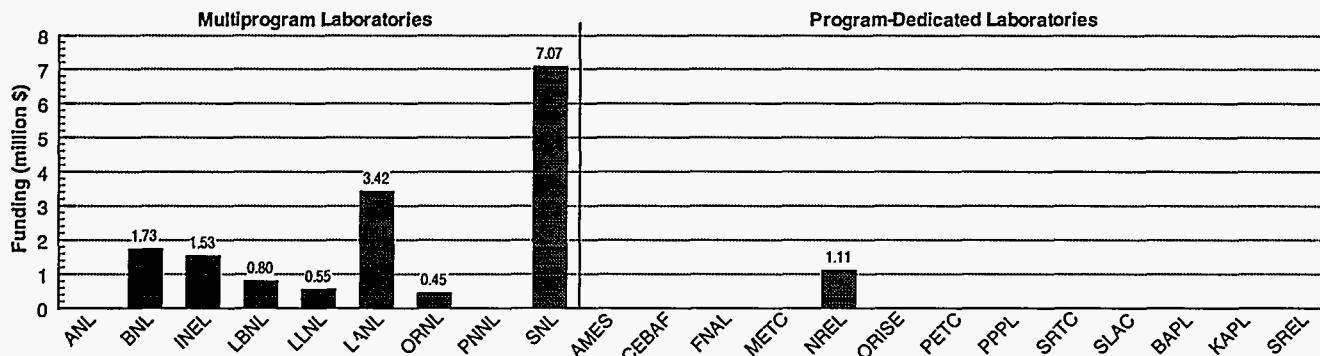


Laboratory-Academia-Industry Participation



Note: Includes ETEC in laboratory partition.

Fiscal Year 1995 Funding Profile



Hydropower

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
 Office: Utility Technologies
 Element: Renewable Energy Conversion
 B&R Code: CE10

Laboratory Complex

Principal Laboratories: INEL
 Contributing Laboratories: None
 Participating Laboratories: ORNL

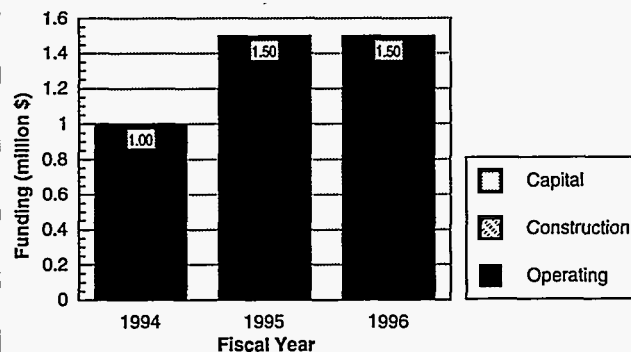
Mission Activity Description

The mission of the DOE Hydropower activity is to conduct research and development, in coordination with industry and other Federal agencies, aimed at improving the technical and environmental benefits of hydropower, thus supporting the DOE mission to achieve diversity in energy sources, a more productive economy, and improved environmental quality. Hydropower is the major renewable energy component in the United States, accounting for about 85 percent of electricity produced from all renewables. The DOE Hydropower activity is focused on the following areas:

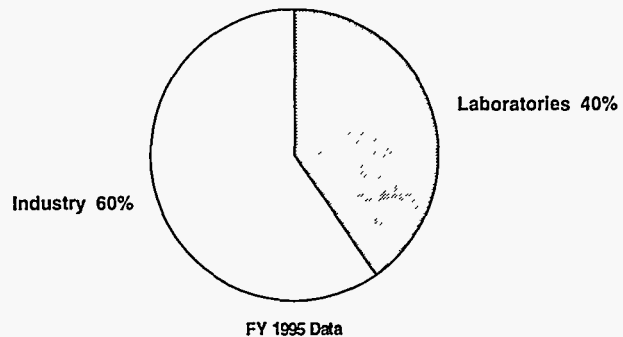
Advanced Turbine Development—In the advanced hydropower turbine systems area, cost-shared projects with industry are conducted to develop and test hydropower turbine technology aimed at balancing environmental, engineering, and cost considerations. The conceptual design phase of this effort is under way, with the award of two cost-shared contracts. The conceptual designs will develop and employ innovative technology intended to reduce injury and mortality to fish and improve water quality at the hydropower project. Planned future phases will proceed to engineering models and model testing, and finally full-scale prototype testing at an operating hydropower plant.

Resource Assessment—Resource assessment activities are conducted to enable the States to assess potential hydropower sites for development feasibility. DOE-developed uniform criteria, standardized methodology, and software enable a State to apply environmental and institutional attributes to a potential site and to determine the likelihood that the site can be developed. In addition, DOE is assisting the States in using these DOE-developed tools. Twenty State hydropower resource assessments have been completed.

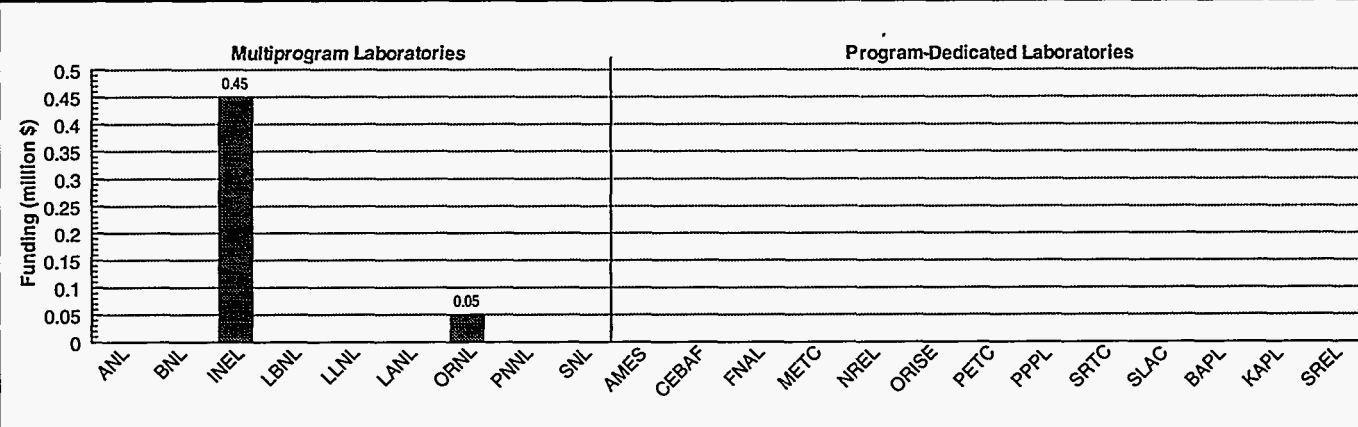
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Electric and Magnetic Field Effects Research

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
 Office: Utility Technologies
 Element: Energy Management
 B&R Code: AK04-

Laboratory Complex

Principal Laboratories: ORNL, PNNL
 Contributing Laboratories: None
 Participating Laboratories: ANL, LBNL

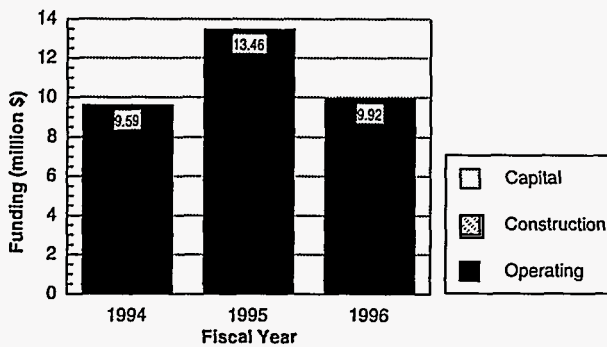
Mission Activity Description

To meet increasing needs for electric power, cost-effectiveness, reliability, and environmental safety must be assured. Public concern over potential health effects of electric and magnetic fields affects all these aspects in the generation, delivery, and use of electricity. The Electric and Magnetic Field Effects Research activity will reduce uncertainty and provide a scientific basis for dealing with the issue.

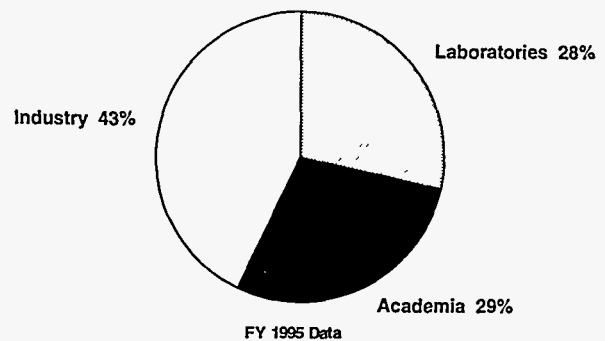
Electric and magnetic fields activities address the basic question of whether exposures to electric and magnetic fields from the generation, delivery, and use of electricity result in adverse human health effects. Since some epidemiological studies have suggested a relationship between field exposures and an increased incidence in certain cancers and other adverse health effects, there has been considerable public concern about this issue. The lack of definite answers to this question has resulted in increasing siting difficulties for new transmission and distribution facilities, which are needed for competitive electric markets and the widespread utilization of remote renewable energy resources, and in the redesign of certain types of electrical equipment and may be an impediment to the adoption of advanced electrotechnologies that are under development.

To address this question, most of the activities are in the areas of focused health effects research on biological pathways linked to the suggested health effects and exposure assessments. The purpose of the research and the exposure assessments is to provide needed information for a risk assessment by the National Institute of Environmental Health Sciences. Concurrently, a multiagency effort is also under way to provide the public and other decisionmakers with information on what we know about this issue and about activities that are being pursued to provide more definitive information.

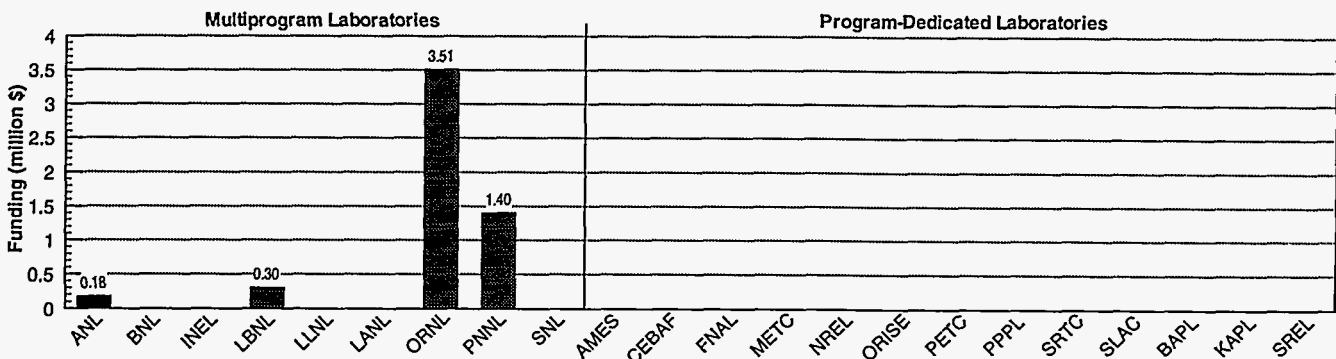
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Electricity Transmission and Distribution Reliability

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Utility Technologies
Element: Energy Management
B&R Code: AK05

Laboratory Complex

Principal Laboratories: ORNL
Contributing Laboratories: None
Participating Laboratories: PNNL

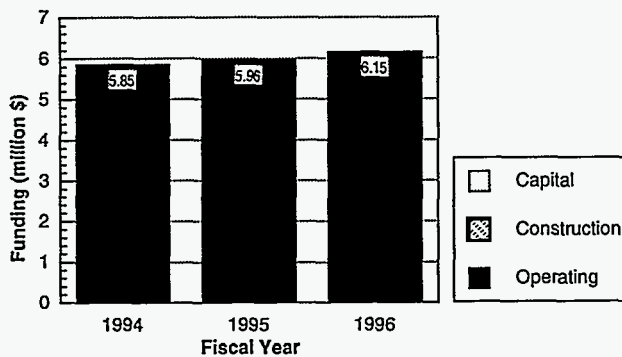
Mission Activity Description

The Transmission and Distribution activity develops and supports the adoption of advanced technologies that increase the flexibility, capacity, and efficiency of the U.S. electric delivery systems to enable more efficient electric markets. These system improvements are in two major areas: (1) the development of sophisticated information management, communication, and control system methodologies that allow real-time, automatic control of the electric power system and the full integration of energy supply, renewable energy, and energy-efficiency resources, and (2) the development of advanced, lower cost power-electronics technologies that increase overall transmission system capacity over existing transmission rights-of-way, reduce the cost of long-distance transmission, which will enable the development of remote renewable energy resources, and lower power-conditioning costs for renewable energy technologies, electric vehicles, and motor controllers.

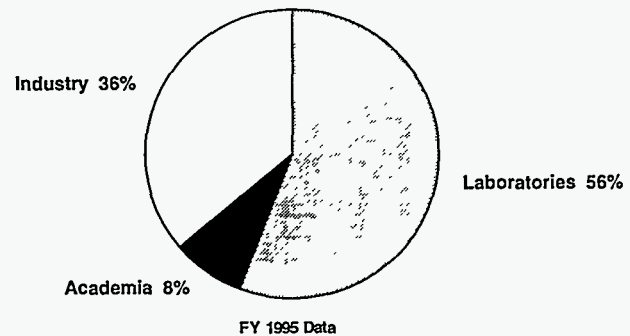
Real-Time Control and Systems Analysis—Real-time control and analysis activities apply advanced communications, computing, and control algorithms to allow operation of future power systems with lower capacity reserve margins, and enable full integration of renewable resources, energy storage, and end-use control technologies. Project activities include case studies with utility partners, and development of economic and technical modeling techniques to assess the impacts on electric power systems of increasing penetrations of renewable energy resources.

Advanced Power Electronics—The advanced power electronics element develops advanced system control and power electronics applications for power delivery and conversion systems to enable increased penetration of renewable energy resources, and more efficient use of existing power systems assets. Project activity is designed to develop low-cost, flexible power-conditioning equipment to interface renewable energy resources with the power system, and optimize a possible hybrid package that also includes storage and load control technologies.

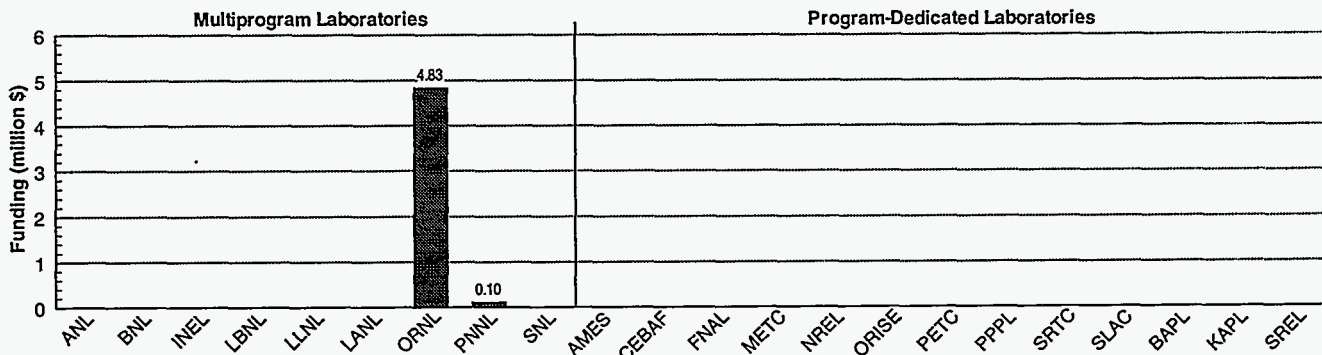
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Energy Storage Systems

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Utility Technologies
Element: Energy Management
B&R Code: AL05

Laboratory Complex

Principal Laboratories: SNL
Contributing Laboratories: None
Participating Laboratories: NREL, PNNL

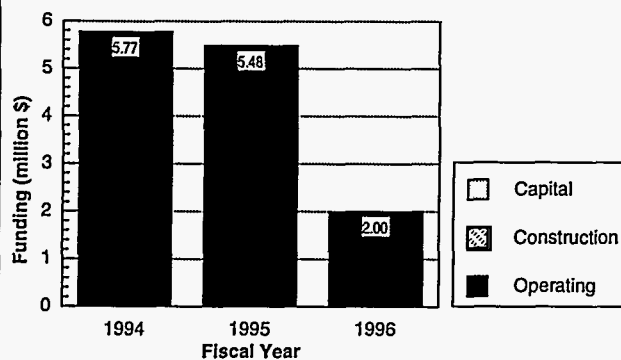
Mission Activity Description

The mission of the Energy Storage Systems (ESS) activity is to assist industry in developing cost-effective energy storage systems as a utility resource option for the year 2010 and beyond. The objectives of the ESS activity are to facilitate the increased use of renewable generation resources by 20 percent by 2010; increase the effectiveness and quality of electricity utilization and thereby improve the productivity per kilowatthour of U.S. industry by \$7 billion through 2010; defer peaking capacity and transmission and distribution system upgrades, reducing needed investment by \$32 billion; and reduce emission of carbon-dioxide from powerplants by 5 million metric tons through the year 2010. These objectives are completely consistent with the Energy Policy Act of 1992, the 1995 National Energy Policy Plan, and the Department of Energy Strategic Plan.

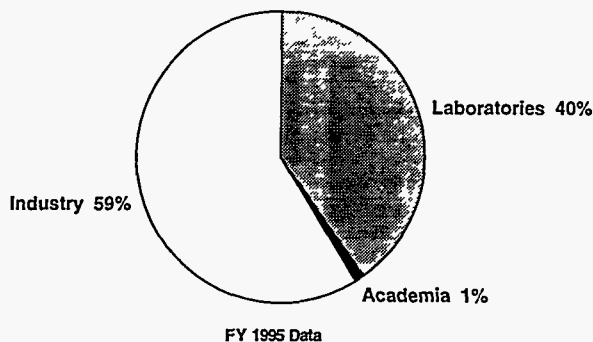
To accomplish its mission, the following research goals have been established: identify and evaluate the benefits of energy storage in utility applications; develop improved storage system components; develop cost-effective, modular, and multifunctional energy storage systems; characterize the performance of integrated systems with onsite field experiments; and increase industry awareness of the benefits of energy storage and options for providing it.

The activity includes development of a 2MW, 10-second power-quality energy storage system (field testing to be initiated in mid-FY 1996); development of an advanced battery system (ABS) using an integrated modular approach to reduce costs (the 0.5 MW 0.5 hr transportable prototype is expected to be ready for initial testing at a utility site in 1997); and development of an integrated renewable generation/storage (RGS) system for application with renewable power generators, a system estimated to increase the potential market penetration levels for renewables by 20 percent by 2010 (completion of prototype turnkey modular systems scheduled for 1999).

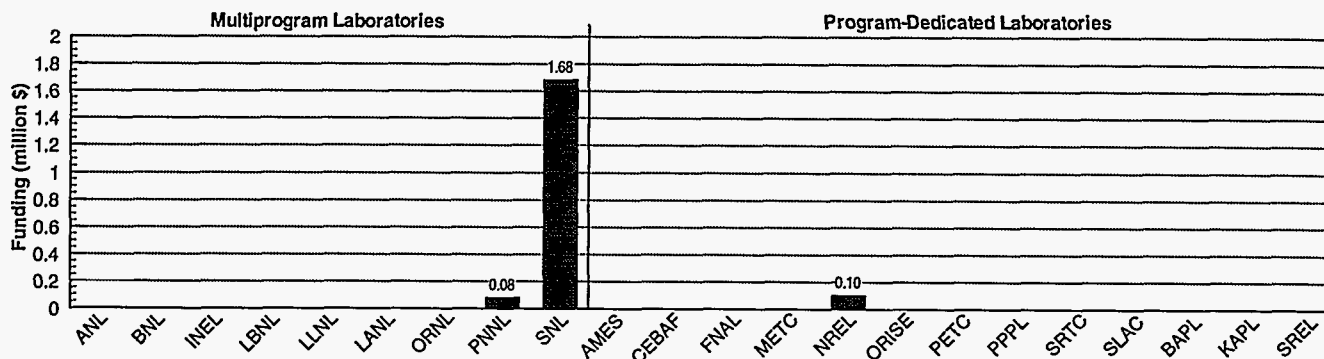
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



High-Temperature Superconductivity

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
 Office: Utility Technologies
 Element: Energy Management
 B&R Code: AK06

Laboratory Complex

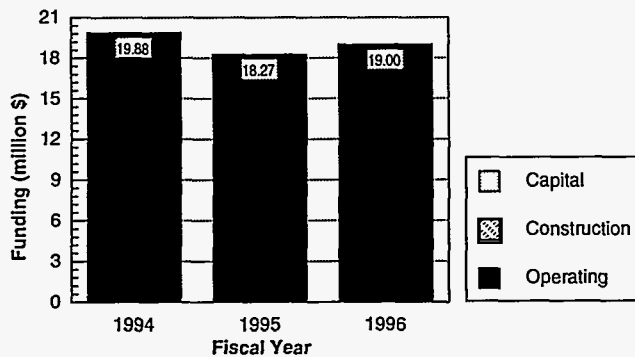
Principal Laboratories: ANL, LANL, ORNL
 Contributing Laboratories: None
 Participating Laboratories: BNL, NREL, SNL

Mission Activity Description

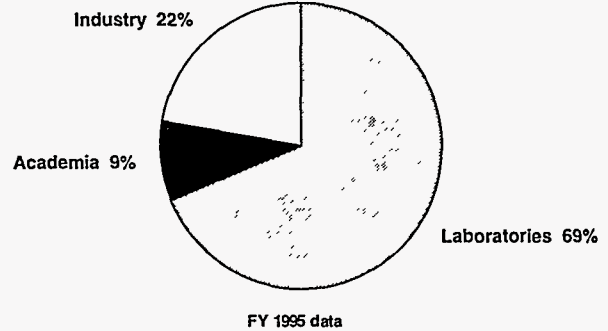
The superconductivity program mission is to develop the technology necessary for U.S. industry to proceed to commercial development of high-temperature superconductor electric applications. This program mission matches the Department mission of improving energy efficiency. The program has two distinct, but highly interdependent parts. The first part of the program provides funds to a DOE superconductivity complex made of expertise and facilities at six major laboratories. These laboratories are charged with using their unique capabilities to work in concert with private companies and universities to establish a U.S. manufacturing capability for high-temperature superconductivity based on research performed by interdisciplinary teams drawn from the labs, companies, and universities. These teams are formed through cooperative research and development agreements (CRADAs) between the labs and private companies, and by subcontracts between the labs and universities. The individual CRADA topics match program goals that advance the technology with company goals that meet their business interest. More than 30 CRADAs and 16 university contracts were active in 1995. The key technology is manufacture of high-temperature superconductivity wire.

In parallel with this effort, the second part of the program supports a strong application thrust, which, while proceeding separately, depends ultimately on the technology being successfully developed. This arm of the program is known as the Superconductivity Partnership Initiative and is carried out through four industry consortia that received awards following a 1993 competition. The industrial consortia are designing super-efficient motors, generators, current limiters, and electric transmission cables. The consortia are unusual in that each contains the full range of the research and development spectrum—the user (usually an electric utility), a manufacturer, and a superconducting component supplier. Industry has the key role in this part of the program. National laboratories are performing research tasks defined by the consortia using the laboratories' unique facilities and expertise. Each consortium project has specific technical and cost goals. These goals are also program goals.

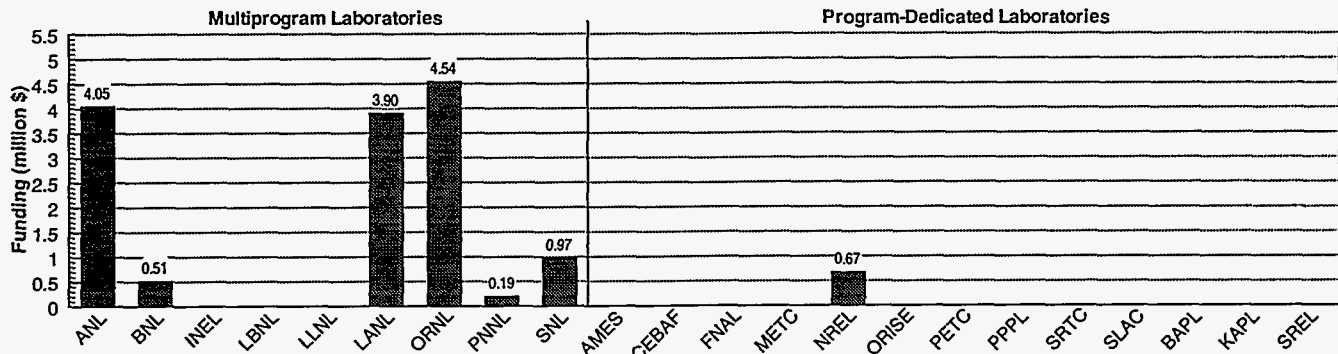
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Hydrogen Research and Development

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Utility Technologies
Element: Energy Management
B&R Code: AR00

Laboratory Complex

Principal Laboratories: NREL, SNL
Contributing Laboratories: LLNL
Participating Laboratories: LANL, ORNL, PNNL

Mission Activity Description

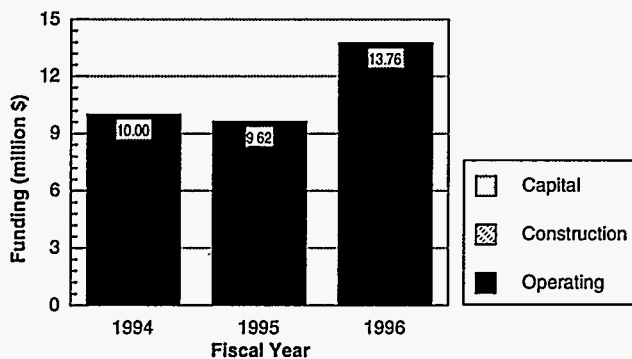
Hydrogen is an energy carrier with the potential to join electricity as a key component of a sustainable energy system. As an energy carrier and fuel, its future integration into the energy economy will help make renewable energy sources viable and practical. The three principal hydrogen research and development areas include:

Hydrogen Production—Hydrogen production technologies in use today are natural gas steam reforming and water electrolysis. Hydrogen is primarily used as a chemical feedstock, but has the potential to be a large-scale fuel produced from renewable resources such as solar energy and biomass. Representative hydrogen production projects include photoelectrochemical water-splitting with semiconductors, photobiology using photosynthetic microbes, biomass gasification and pyrolysis, and electrolysis using electricity from the grid or from renewable-based generation.

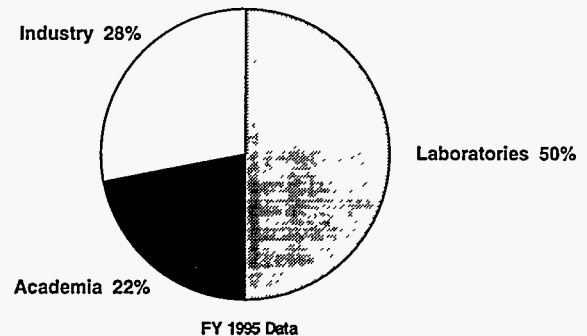
Hydrogen Transport and Storage—Hydrogen is an energy carrier that can be stored and transported in several physical forms depending on the intended application. Hydrogen can serve as a storage medium for electricity produced from intermittent renewables for stationary applications as well as onboard vehicle storage systems. Hydrogen storage and transport can serve similar roles and complement natural gas storage and pipeline systems being delivered to end-users. Hydrogen storage methods being investigated include pressure vessels, cryogenic dewar, metal hydrides, carbon adsorption, sponge iron, glass microspheres, novel materials, and underground caverns. Transportation methods include pipelines, trucks, railcars, barges, and tankers.

Hydrogen Utilization—Improved utilization technology will aid hydrogen's use as a transportation fuel and as an energy source and storage medium for industry and utilities. In the transportation sector, the leading technologies include the use of hydrogen in fuel cells and internal combustion engines. Pure hydrogen and hydrogen fuel blends are considered appropriate for internal combustion engines.

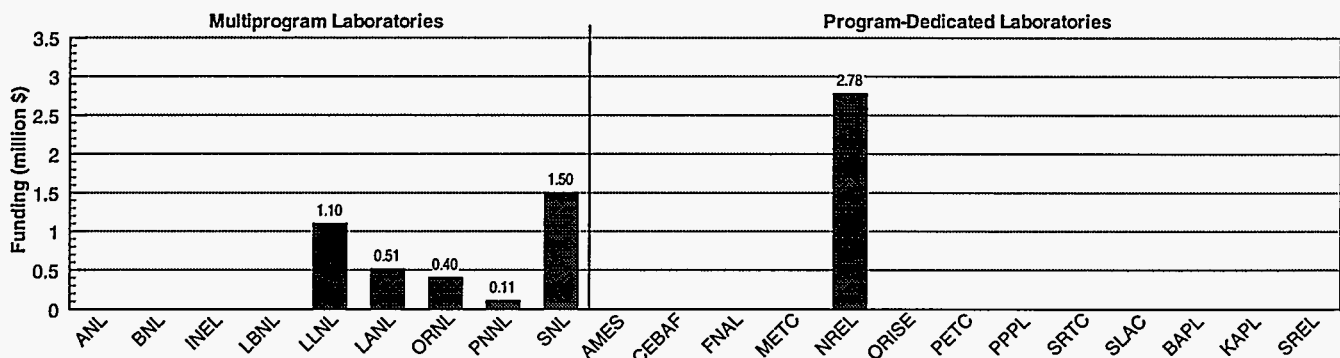
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Building Systems

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Building Technologies
Element: Building Energy Research
B&R Code: EC10

Laboratory Complex

Principal Laboratories: NREL, LBNL, ORNL
Contributing Laboratories: PNNL
Participating Laboratories: ANL

Mission Activity Description

The mission of the Building Systems activity is to improve dramatically the overall energy efficiency in commercial and residential buildings by improving the performance and integration of energy systems in buildings. The activity enables building owners and developers to capture cost-effective and significant energy-saving opportunities by combining research on optimal system designs with programs that deploy these energy-efficiency strategies in new building construction and existing building retrofits. Four subprograms contribute to the mission: residential buildings; commercial buildings; retrofit technologies; and best practices.

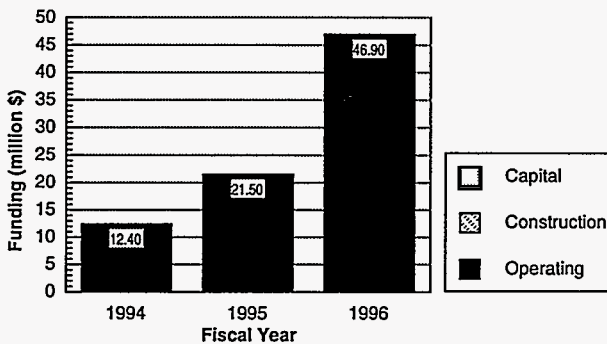
The *residential buildings* subprogram focuses on the application of systems engineering, factory production, and innovative building products to produce a new generation of housing that is 50 percent more energy efficient than today's construction, that is less costly to build, and that generates less waste during construction, operation, and ultimate disposal or recycling.

The *commercial buildings* subprogram aims to increase the adoption of energy-efficient control strategies and sound operation and maintenance practices within commercial and multifamily buildings. The main activity is the development of advanced controls and diagnostic tools for use in operation and maintenance performance analysis.

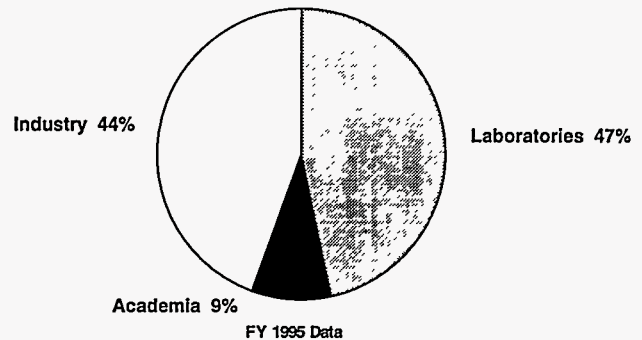
The *retrofit technology* subprogram seeks to increase the adoption of energy-efficient and renewable energy technologies into the Nation's stock of existing buildings.

The *best practices* subprogram is designed to make a collective contribution to defining "energy excellence" within the buildings sector by ensuring that cost-effective, energy-efficient, and renewable energy technologies and practices are given full consideration in the design of new buildings.

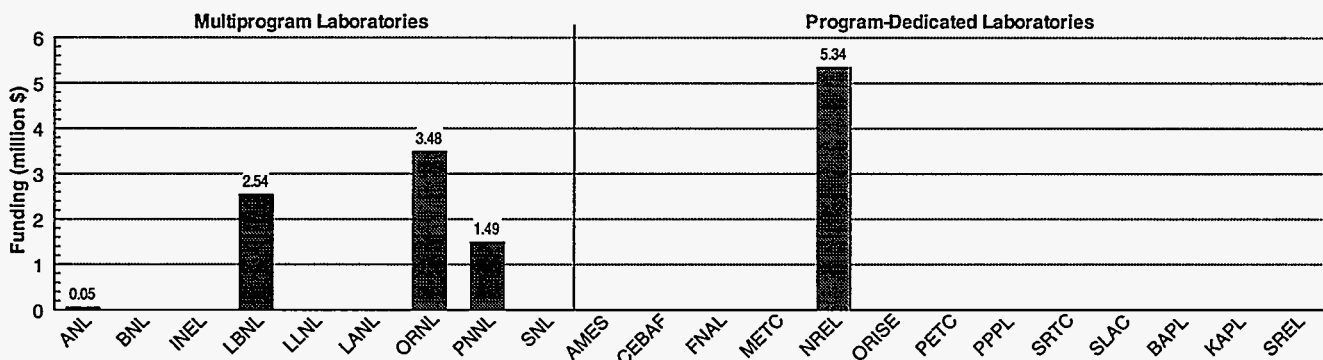
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Building Envelopes

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Building Technologies
Element: Building Energy Research
B&R Code: EC12

Laboratory Complex

Principal Laboratories: LBNL, ORNL
Contributing Laboratories: None
Participating Laboratories: NREL, PNNL

Mission Activity Description

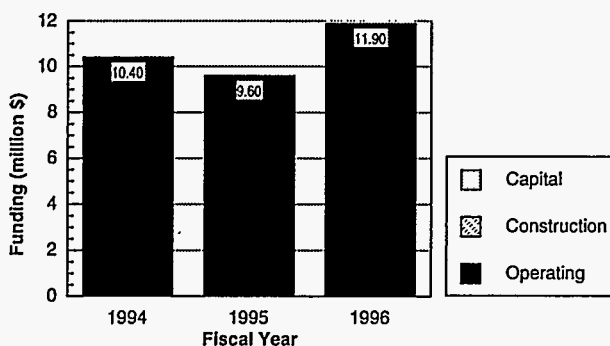
The mission of the Building Envelopes activity is to provide the technology options for the design of zero net heating and minimal cooling energy building envelopes by the year 2000 without adversely affecting the indoor environment. This will be achieved by maintaining a strong fundamental research base along with the support of key, highly leveraged, industry cost-shared programs. The program consists of a combination of research, manufacturing development, and testing in three areas: materials and structures; windows and glazing; and indoor air quality.

Materials and structures research focuses on the development of advanced insulation materials, and the application of advanced materials in building walls, roofs, and foundations.

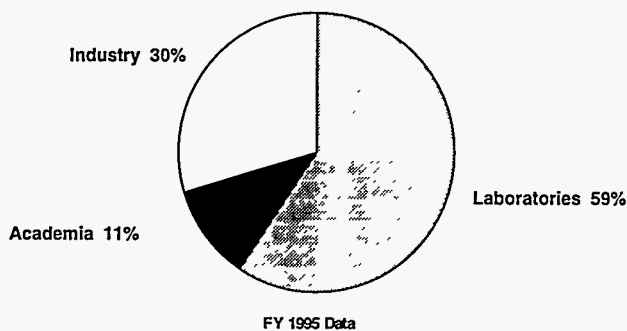
The windows and glazing activity is developing advanced technologies that will greatly improve the thermal and optical performance of windows, doors, and skylights, coupled with design, rating, and technical performance information that is needed to achieve accelerated market adoption of new fenestration technologies. Research currently focuses on electrochromic glazing with dynamically controllable optical properties and on advanced "spectrally selective" window coatings and films. Fenestration performance and simulation research is being carried out to establish a sound technical basis for performance rating and labeling of window products, and to provide upgraded design tools for use by manufacturers in improving the performance of their products.

Finally, indoor air-quality activities focus on research aimed at achieving a high level of indoor air quality without energy penalties.

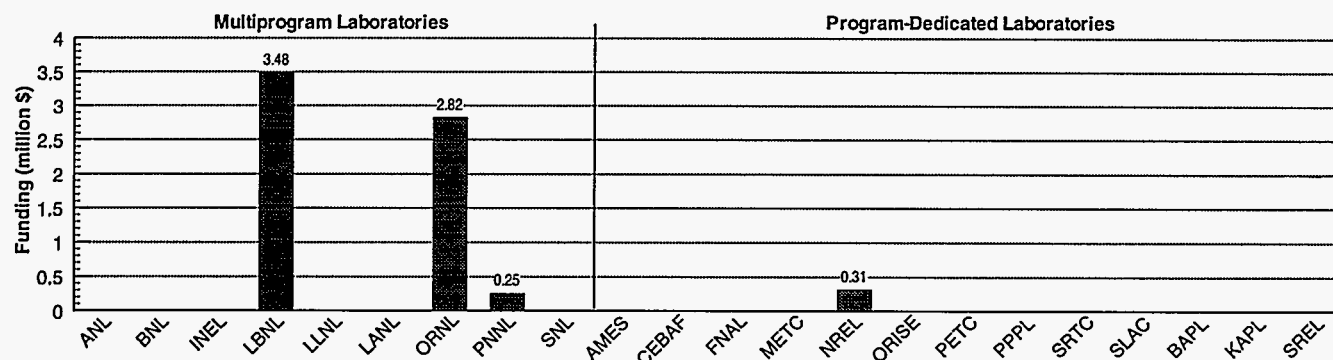
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Building Equipment

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Building Technologies
Element: Building Energy Research
B&R Code: EC13

Laboratory Complex

Principal Laboratories: ORNL, PNNL
Contributing Laboratories: LBNL
Participating Laboratories: BNL, NREL

Mission Activity Description

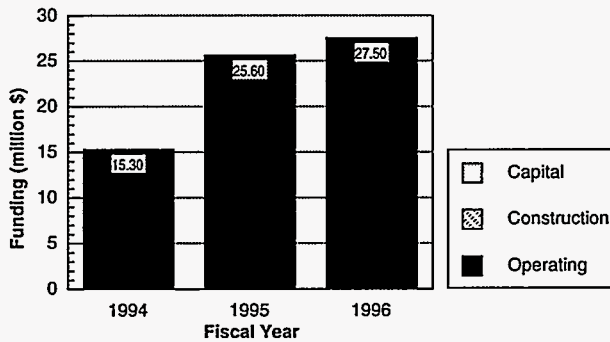
Building Equipment is a comprehensive research, development, and deployment activity conducted in cooperation with the private sector to provide industry with the advanced technology base needed for highly efficient, globally competitive building equipment and to accelerate its adoption and widespread utilization.

The Building Equipment activity has two primary thrusts: heating and cooling research and development (R&D) and lighting and appliances R&D. Heating and cooling efforts focus on development of high-efficiency natural gas and electrical heat pump and air-conditioning equipment, as well as development of oil combustion technologies. It addresses such technological challenges as development of non-CFC refrigerants, recapture (from the Japanese) of the technological lead in gas absorption technology, and development of critical data on exploratory technologies such as electrohydrodynamic heat exchangers, microelectromechanical systems, and novel refrigeration cycles.

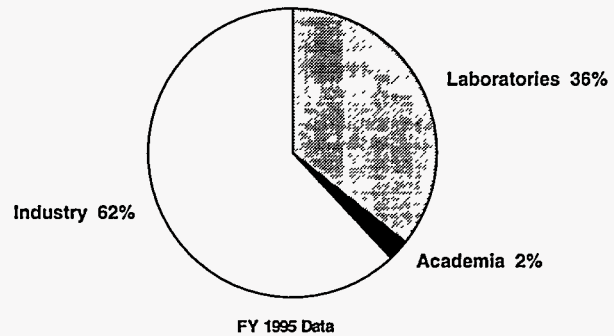
Lighting and appliances R&D focuses on development of advanced technology for providing lighting, hot water, refrigeration, office automation, and other services for buildings, and includes both evolutionary and revolutionary technology approaches to achieving this goal.

The Building Equipment activity conducts a Technology Introduction Partnerships (TIPS) activity to encourage and facilitate entry of high-efficiency building equipment technologies into the marketplace. TIPS employs significant interaction with manufacturers, utilities, retailers, and other stakeholders to overcome market-based barriers to technology deployment. It is an umbrella activity that considers all high-efficiency building equipment technologies that are ready for commercialization (not just those developed by the Department of Energy) that might otherwise be slow to penetrate the market.

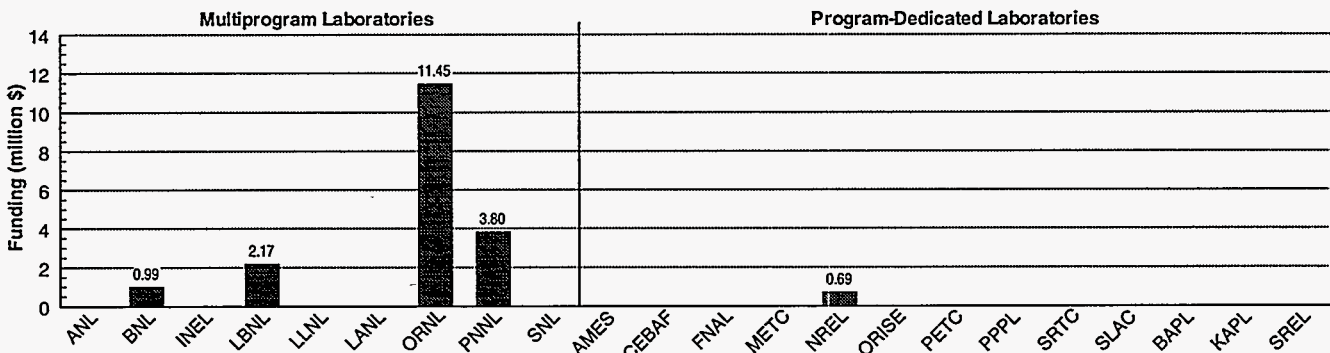
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Codes and Standards

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Building Technologies
Element: Codes and Standards
B&R Code: EC14

Laboratory Complex

Principal Laboratories: PNNL, LBNL
Contributing Laboratories: NREL
Participating Laboratories: ORNL

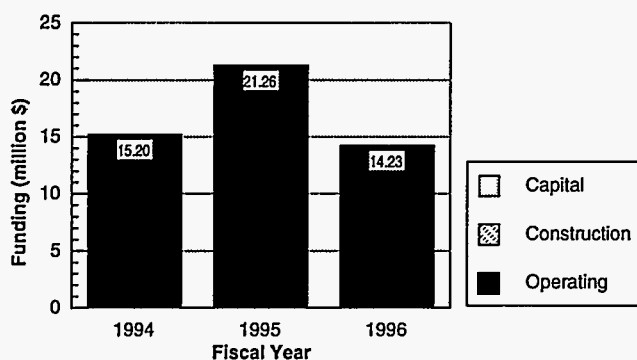
Mission Activity Description

The purpose of the Codes and Standards activity is to implement a legislatively mandated multiyear program to improve the efficiency of energy use in the Nation's buildings by establishing energy-efficiency standards, codes, and guidelines for buildings, building equipment, and appliances. Setting efficiency standards increases minimum efficiency levels and leads to substantial increases in the average energy performance of buildings and equipment. The activity is composed of two elements:

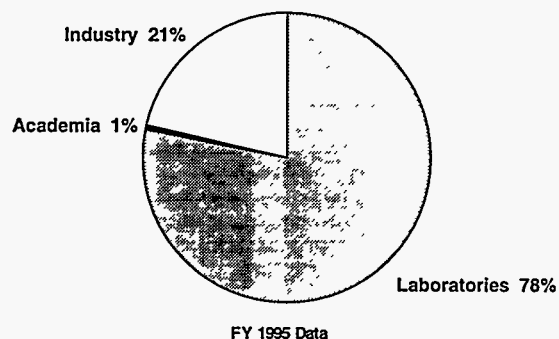
Lighting and Appliance Standards—This subprogram performs three functions: appliance and efficiency testing, labeling, and standards establishment. The Department of Energy prescribes test procedures that measure the energy efficiency and energy use and provide an estimate of the energy cost of each appliance; DOE and the Federal Trade Commission share responsibility for labeling. The Department also establishes and promulgates energy-efficiency standards designed to achieve the maximum improvement in energy efficiency that is technically feasible and economically justified. The Department actively encourages the participation and interaction of all interested parties at all stages of the rulemaking process.

Building Standards and Guidelines—The Building Standards and Guidelines subprogram strategy is to promote, assist, and act as a catalyst in developing and implementing building energy-efficiency codes, standards, and guidelines that are technically feasible, economically justified, and environmentally beneficial. By working in the market to eliminate the most inefficient technologies and building practices, this program complements the Department's efforts to develop and introduce advanced, highly efficient technologies. The program provides assistance to States to update and implement their building energy codes, assists building industry voluntary codes organizations to update their codes to include measures that are technically feasible and cost-effective, promulgates Federal building energy-efficiency standards, and assists with the development, testing, and deployment of energy-efficient financing mechanisms.

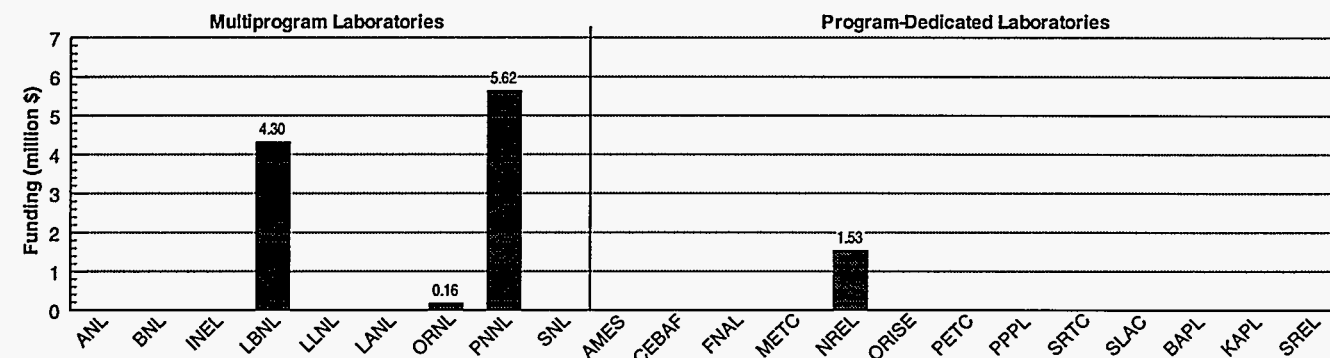
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Federal Energy Management Program

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Federal Energy Management
Element: Federal Energy Management
B&R Code: EC26

Laboratory Complex

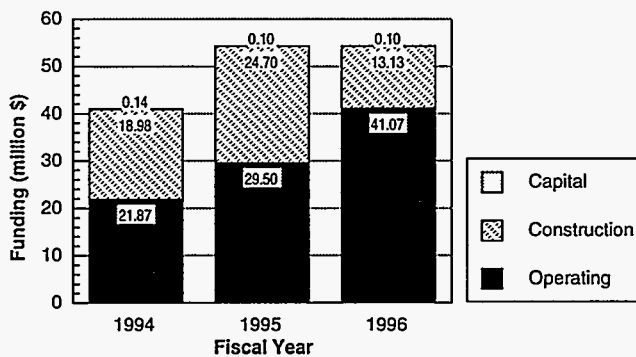
Principal Laboratories: NREL, LBNL, PNNL
Contributing Laboratories: None
Participating Laboratories: ANL, BNL, INEL, LANL, LLNL, ORNL, SNL

Mission Activity Description

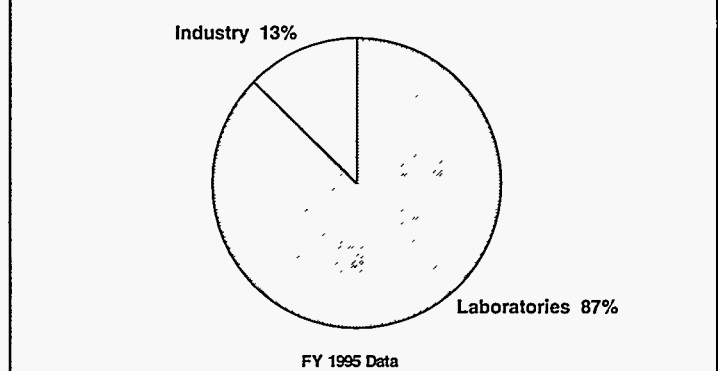
The Federal Energy Management Program (FEMP) carries out the DOE mission by example, leading and coordinating the Federal Government's energy-efficiency efforts. FEMP's outreach, technical assistance, and interagency coordination provide Federal leadership and customer-focused assistance necessary to achieve aggressive energy-efficiency goals. National laboratories provide key services in transferring to Federal energy managers critical design, operations, and financing information on innovative efficiency and renewable energy technologies. Special emphasis is placed on expanding the range and availability of energy project financing mechanisms, targeting private-sector funding through energy savings performance contracts and utility incentive programs, and including efficiency services in utility-area-wide contracts.

The In-House Energy Management Program (IHEM) leads the Department of Energy's facility energy-efficiency efforts, as part of the overall Federal effort. IHEM, working directly with DOE and national laboratory facility staff, identifies retrofit projects and modifications that save energy or water and have a high return on investment. IHEM has historically provided funding from its budget for high-priority energy-savings projects at DOE Headquarters and field sites, including national laboratory facilities. Many projects leverage non-Federal resources, such as utility rebates and private-sector financing. Each dollar invested at DOE facilities for energy efficiency yields approximately \$5 in net return. IHEM has reduced building energy consumption 24 percent since FY 1985, already achieving the FY 2000 goal, resulting in \$100 million in annual avoided utility expenses. However, significant energy reductions can still be achieved at DOE sites, since it still has the highest energy consumption of all civilian Federal agencies. IHEM has been a part of the President's Investment Program for Federal Facility Energy Efficiency since fiscal year 1984.

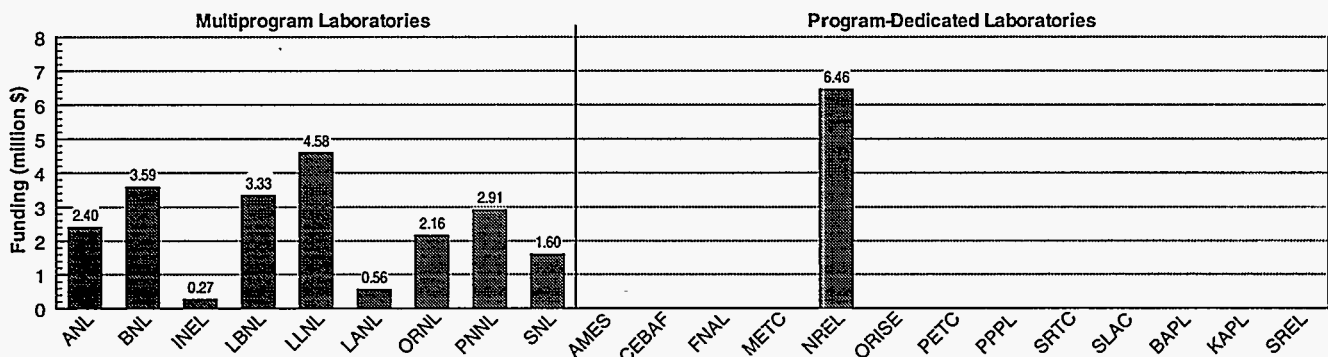
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Building Technologies Implementation and Deployment

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Building Technologies
Element: Implementation and Deployment
B&R Code: EC27

Laboratory Complex

Principal Laboratories: LBNL
Contributing Laboratories: ORNL
Participating Laboratories: PNNL

Mission Activity Description

The mission of the Implementation and Deployment activity is to ensure that results generated by the Buildings Program reach the widest possible audience in the shortest possible time. Technical and scientific information must be customized to be understandable and useful to an array of building community stakeholders, including building and homeowners and tenants, lenders, builders and contractors, the real estate industry, State and local government agencies, industry (including trade associations), utilities, and others.

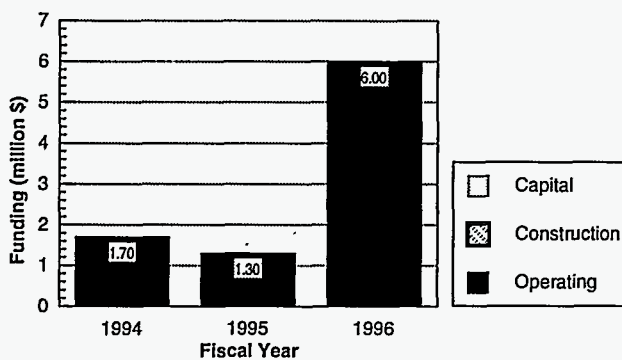
Complementing existing industry-government research partnerships, the Implementation and Deployment activity ensures an effective mix of technology-push and market-pull strategies. These strategies accelerate the use of DOE-developed and DOE-codeveloped technologies into the marketplace. Activities under this program include education and training, information outreach and technical support, and Cool Communities support.

Education and Training—Education and training activities use the existing infrastructure including trade associations (such as the Building Owners and Managers Association), the Federal Energy Management Program, and State energy offices to establish operation and maintenance training for commercial building operators.

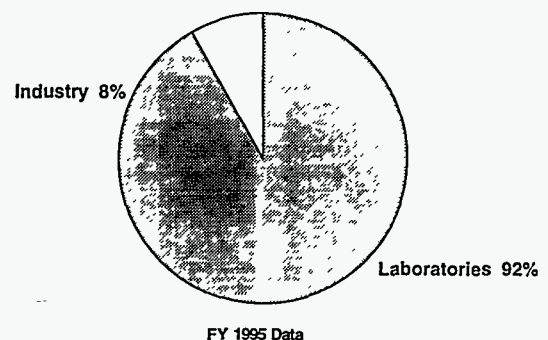
Information Outreach and Technical Support—Information outreach and technical support focuses on utilizing existing networks and developing other networks for disseminating information products.

Cool Communities Initiative—Given that urban areas create “heat islands” with summer temperatures from 2 to 4 degrees higher than surrounding areas, Cool Communities activities concentrate on quantifying this effect and verifying mitigation opportunities and savings.

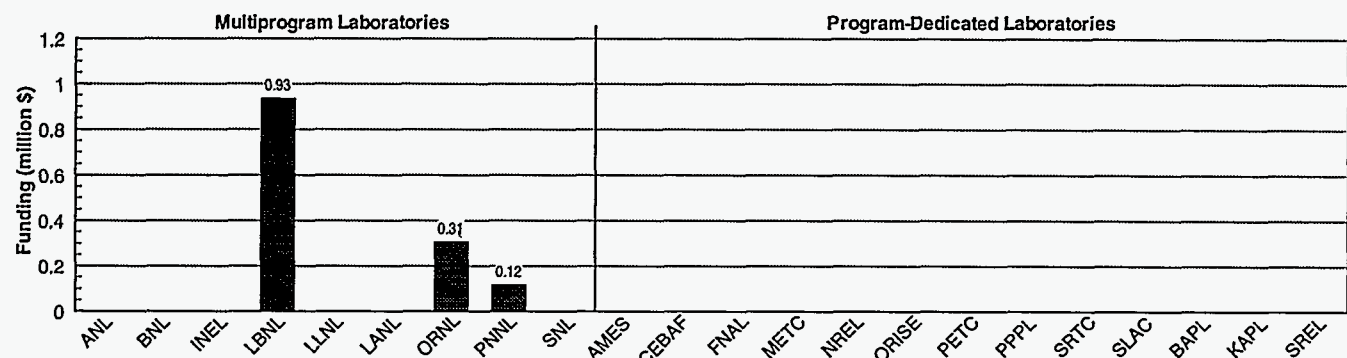
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Cogeneration

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Industrial Technologies
Element: Industrial Processes
B&R Code: ED20

Laboratory Complex

Principal Laboratories: ORNL
Contributing Laboratories: None
Participating Laboratories: ANL, INEL, NREL, PNNL

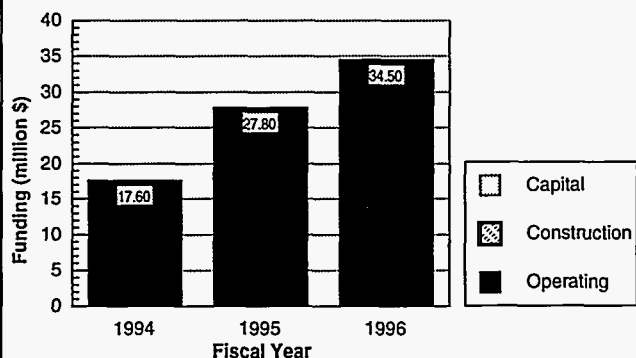
Mission Activity Description

Cogeneration technology enables U.S. industry to greatly improve the efficiency of power generation by using waste steam for productive industrial processes, particularly in energy-intensive industries such as chemicals, petroleum refining, and forest products. Cogeneration increases fuel efficiency to 60 to 80 percent—well above the typical electric utility efficiency of 35 percent. This increase in efficiency reduces industry's demand for fossil fuels used for power generation and the air emissions associated with combustion. The DOE cogeneration activity provides critical research needed for industry to develop new steam and gas turbine technologies expected to result in 21,000 megawatts of new cogeneration capacity (in addition to the expected 97,000 megawatt growth using conventional technology) by the year 2015. These new systems will greatly increase the energy productivity of U.S. businesses, reduce adverse environmental impacts associated with fossil fuel combustion, and reduce the vulnerability of manufacturers to energy supply disruptions.

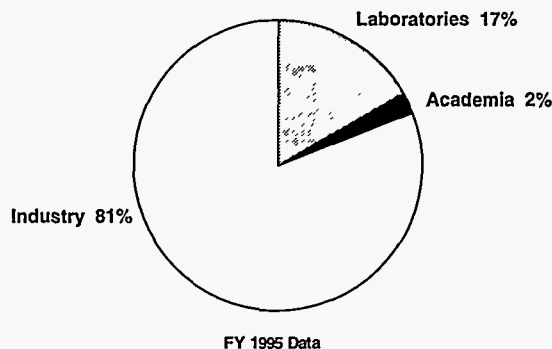
The work of the Continuous Fiber Ceramic Composite (CFCC) subprogram supports and strengthens the Advanced Turbine Systems Program by developing reinforced ceramic components that can withstand the increased turbine inlet temperatures necessary for enhanced turbine efficiency.

The Advanced Turbine System (ATS) subprogram, which focuses on gas turbine technology for both cogeneration and simple-cycle applications, represents the major component of the cogeneration activity. The Office of Industrial Technologies is developing an industrial-scale (up to 20-MW) advanced gas turbine that will have 15 percent higher efficiency than current gas turbines while achieving acceptable levels of reliability, availability, and maintainability. Initially the turbine is to be fueled with natural gas; in the future, low-grade fuels such as biomass and coal are expected to be used. The advanced gas turbine will also significantly reduce emissions of nitrogen oxides, carbon monoxide, and unburned hydrocarbons. Research and development is being conducted to develop selected ceramic components that will allow turbine firing temperatures approaching 2,600°F (compared with the current 2,350°F).

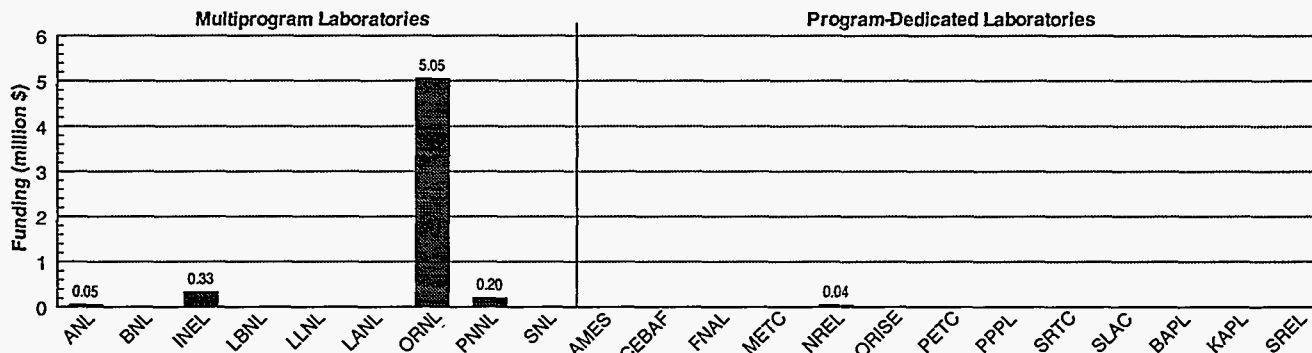
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Process Heating and Cooling

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Industrial Technologies
Element: Waste Reduction Technologies
B&R Code: ED21

Laboratory Complex

Principal Laboratory: ORNL, SNL
Contributing Laboratories: ANL
Participating Laboratories: INEL, LLNL, NREL

Mission Activity Description

The Process Heating and Cooling activity contributes to the Department's energy resources mission by improving the technologies of industrial process heating and cooling. These technologies—principally energy conversion equipment, heat transfer equipment, and heat pumps—are key to improved industrial productivity as well as higher energy efficiency. Advanced combustion technology, in particular, can also reduce environmental pollution and thereby eliminate the need for costly "add-on" pollution controls.

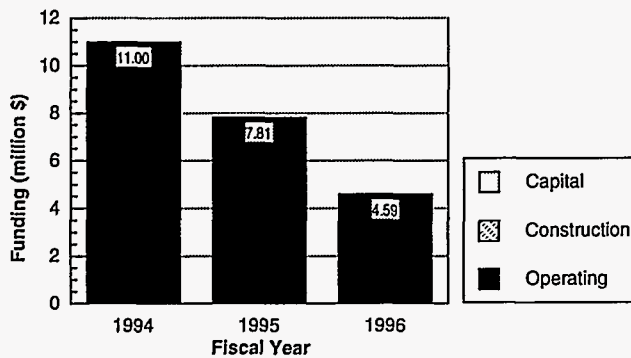
The Process Heating and Cooling activity sponsors research and development of heat exchangers, heat pumps, burners, and related equipment and controls to improve the efficiency of systems that provide direct or indirect process heat. Many of the systems being investigated recover and utilize waste heat produced onsite at industrial facilities such as steel mills, chemical manufacturing facilities, refineries, and pulp and paper mills. By recovering the energy embodied in waste fuels and waste heat, the new systems reduce primary energy use while increasing productivity through more efficient thermal processes. The process heating and cooling research and development projects are discussed below.

Heat exchanger research focuses on the recovery of high-quality waste heat that cannot be used with conventional technology because it is too corrosive or erosive.

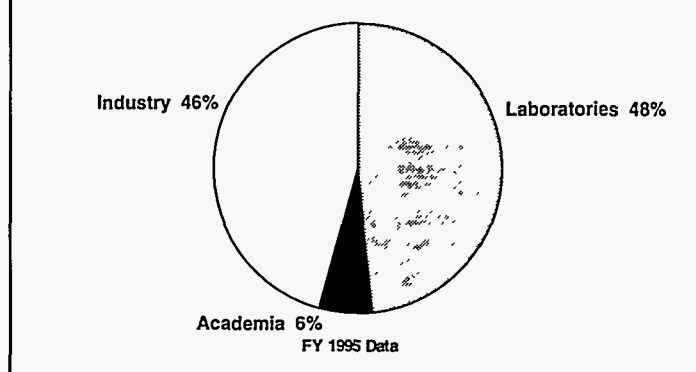
The heat pump program area continues to develop chemical heat pumps that will permit temperatures to be boosted 200 degrees Fahrenheit in a single step versus the 50 to 100 degrees Fahrenheit available from conventional heat pumps.

In support of the Energy Policy Act of 1992, the Office of Industrial Technologies is working with industry to develop high-efficiency combustion equipment that has low nitrogen oxide emissions, uses natural gas, and does not require "add-on" controls to meet the most stringent emission targets.

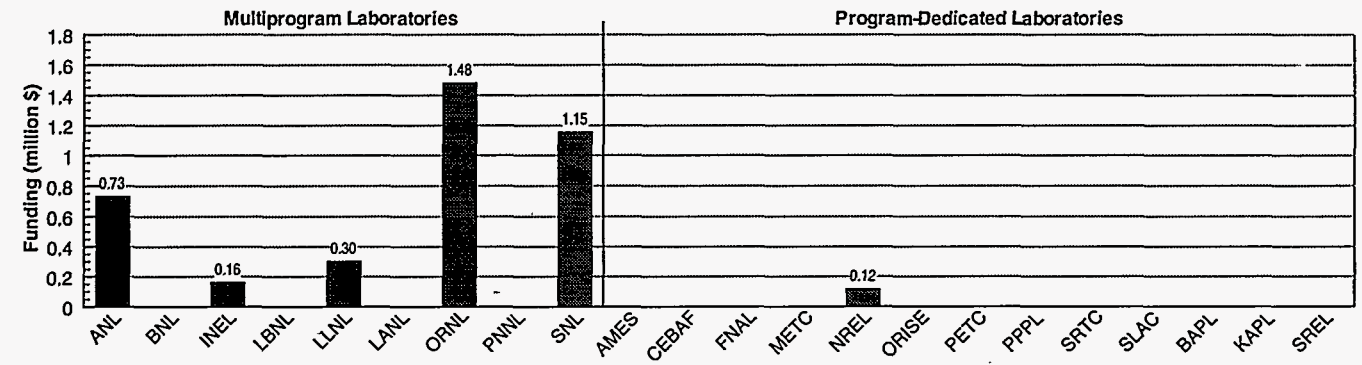
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Materials and Metals Processing

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Industrial Technologies
Element: Industrial Processes
B&R Code: ED22

Laboratory Complex

Principal Laboratories: LANL, ORNL
Contributing Laboratories: None
Participating Laboratories: ANL, INEL, LBNL, NREL, PNNL, SNL

Mission Activity Description

The Materials and Metals Processing activity has four major subcategories: the Metals Initiative; process electrolysis; foundries and glass; and advanced industrial materials. The Metals and the Metal Casting Initiatives are mandated by Congress.

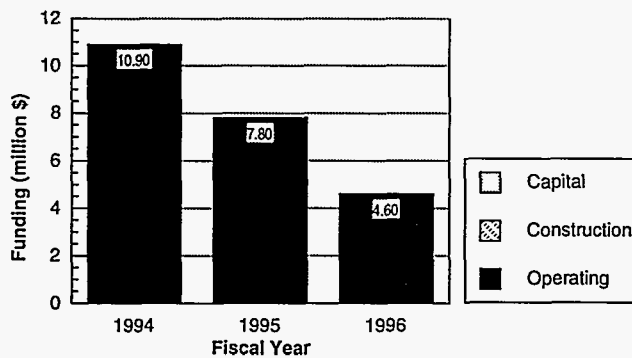
Metals Initiative projects are designed to provide cost-shared funding to support research and development (R&D) for the metals industries. These projects are designed to save energy, increase competitiveness, and improve the environment. Government laboratories act as subcontractors to industry. Industry selected the laboratories without DOE intervention using their own procurement practices, including competitive bidding. The laboratories are developing a number of sensors to continuously monitor the steel manufacturing process: (1) sensors to continuously monitor steelmaking furnace offgases and measure the molten steel temperature; (2) sensors to measure the iron-zinc phases in coated steels; (3) sensors to measure the temperature of coated steels as they are manufactured; (4) sensors to determine the physical properties of steel as it is rolled.

Process electrolysis work concentrates on nonferrous metals, including aluminum, magnesium, and copper. Work concentrates on improved technologies for energy efficiency and for new electrolytic methods. New concepts are transferred to the metals initiative for demonstration.

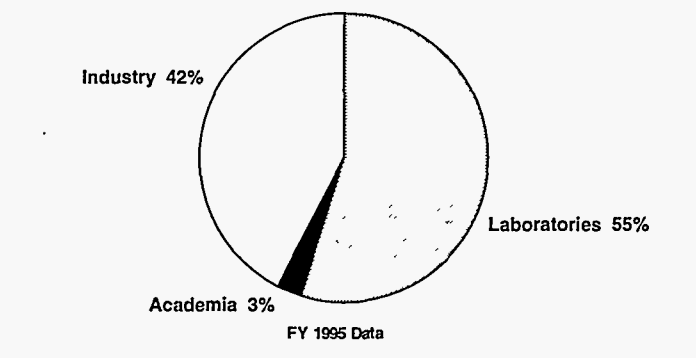
New metal casting technologies processes and alloy applications are being developed to reduce casting production time, improve casting quality and market application, increase foundry equipment lifetime, and minimize the environmental impact of the casting process. Environmental technologies are being targeted to achieve 100 percent pre- and post-consumer recycling, 75 percent beneficial reuse of foundry byproducts, and complete elimination of waste streams.

The glass industry strategy is designed to meet key technology needs identified by the industry in a long-term R&D vision. The industry has indicated advancement opportunities in the areas of production efficiency, energy and conservation, environmental protection, and innovative uses.

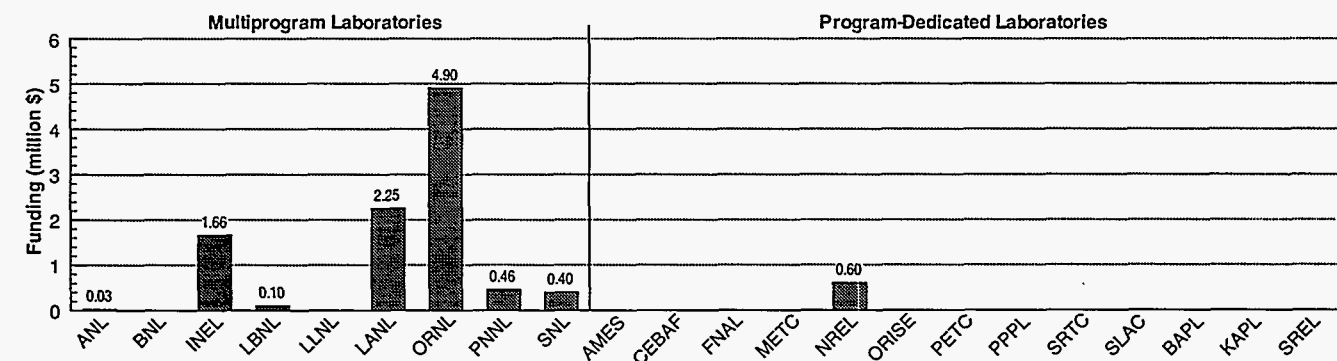
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Process Efficiency

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Industrial Technologies
Element: Waste Reduction Technologies
B&R Code: ED23

Laboratory Complex

Principal Laboratory: ORNL
Contributing Laboratories: ANL, NREL, PNNL
Participating Laboratories: Ames, INEL, LANL, LBNL, PETC, SNL

Mission Activity Description

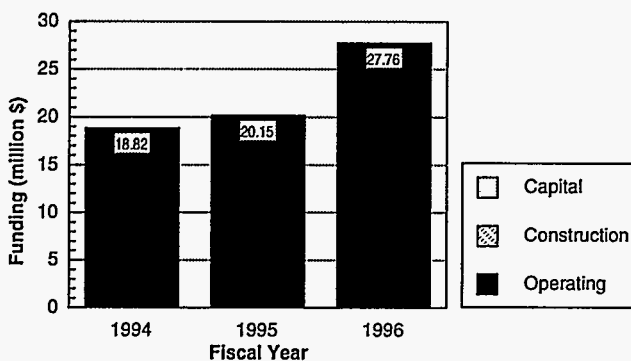
The Process Efficiency activity concentrates on improving efficiency in the energy-intensive process industries that provide the foundation for the U.S. manufacturing infrastructure, including chemicals, petroleum refining, pulp and paper, food, textiles, and agriculture. These industries are among the largest industrial energy consumers and generators of wastes. Development of leading edge process technologies in these industries is considered a key strategy for building and maintaining a strong industrial sector in today's highly competitive global marketplace. Specific research and development (R&D) activities include:

Chemicals and Petroleum Refining—R&D activities are conducted in support of the Office of Industrial Technologies' (OIT) Industries of the Future strategy, which interfaces with the chemicals and petroleum refining industries. Current process improvement efforts are directed toward increasing the efficiency of separation processes, including membrane technologies for energy-intensive gas and liquid separations. Catalytic membranes are also being explored as alternatives to conventional energy-intensive processes used in the production of high-volume chemicals.

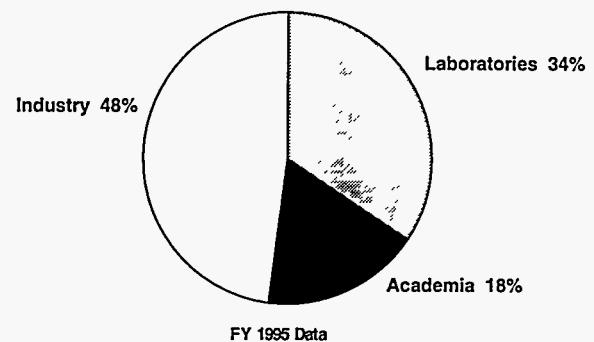
Pulp and Paper—In support of OIT's Forest Products of the Future program, R&D activities focus on the most energy-intensive process steps in the pulp and paper mill, such as chemical and mechanical pulping, chemical recovery, and papermaking. Technology highlights include a demonstration unit for a pulse combustion black liquor gasifier, and a new process to produce anthraquinone from lignin, a pulping catalyst.

Food, Textiles, and Agriculture—In food and agriculture, R&D is conducted on sensors and controls for drying processes, farm fertilizer use, and efficient irrigation practices.

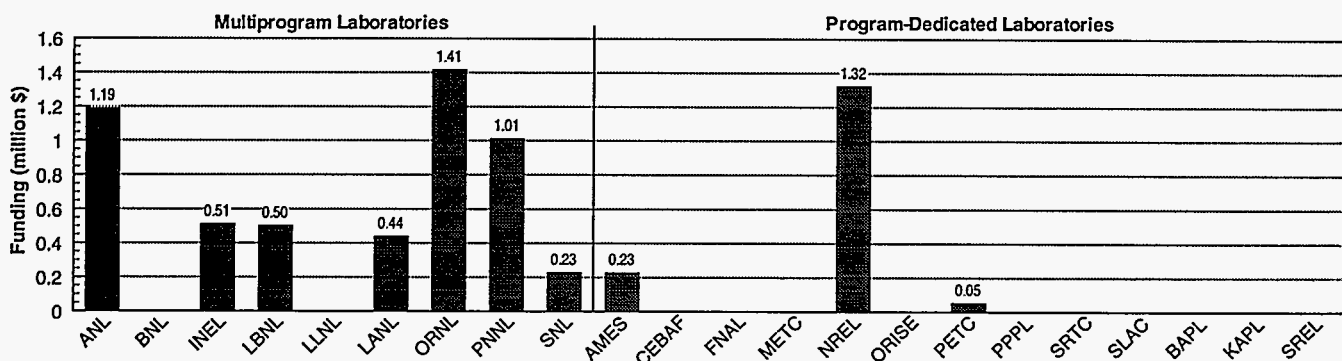
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Industrial Waste

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
 Office: Industrial Technologies
 Element: Waste Reduction Technologies
 B&R Code: ED30

Laboratory Complex

Principal Laboratories: ANL, NREL
 Contributing Laboratories: LANL, PNNL
 Participating Laboratories: INEL, ORNL

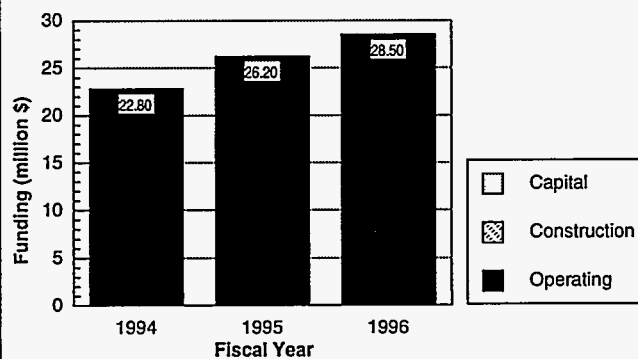
Mission Activity Description

The Industrial Waste activity seeks to improve the efficiency of industrial processes by reducing waste at the source and using wastes as productive feedstocks and fuels. U.S. industry generates roughly 14 billion tons of solid and gaseous wastes each year, with 60 percent generated from manufacturing operations. While estimates of energy associated with reduced wastes are speculative, at least 3 quads and as much as 9 quads of energy could be conserved by source reduction or by using industrial waste as a fuel.

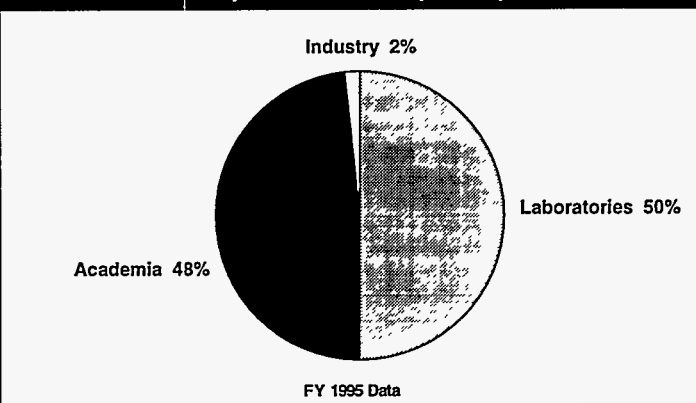
The Industrial Waste activity addresses the problem of industrial waste through research, development, and demonstration in waste reduction, utilization, and conversion. Research is conducted by national laboratories, universities, and industry in support of the energy-intensive process industries targeted under the Office of Industrial Technologies' (OIT) Industries of the Future program. Many pollution prevention opportunities are in these major process industries, such as chemicals, petroleum refining, and primary metals, which account for 80 percent of industrial wastes and 78 percent of energy use in manufacturing. The activity also funds projects in other industries such as automotive, aerospace, electronics, and industrial equipment where there is significant potential to make an industrywide impact on waste streams.

Waste reduction projects target process inefficiencies and seek to reduce waste at the source, before it is generated. Current research and development (R&D) include the following: microwave dissociation technology for in-process recycling of hydrogen sulfide waste; in-process recycling of electroplating waste; and pervaporation technology for the recovery and reuse of volatile organic compounds. Waste utilization and conversion projects are directed at using industrial and postconsumer waste streams productively when source reduction is not feasible or environmentally sound. R&D is currently focused on utilization of waste from scrapped automobiles, food processing waste, scrap plastics or polymers, textile mill scrap, paper waste, certain scrap metals, and wood waste.

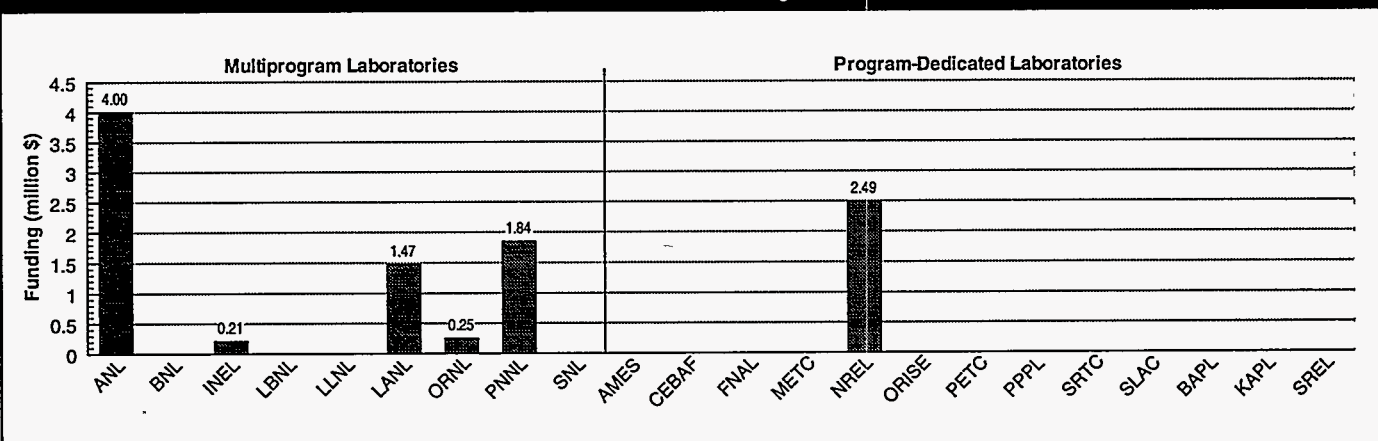
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Municipal Solid Waste

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Industrial Technologies
Element: Waste Reduction Technologies
B&R Code: ED31

Laboratory Complex

Principal Laboratories: NREL
Contributing Laboratories: None
Participating Laboratories: None

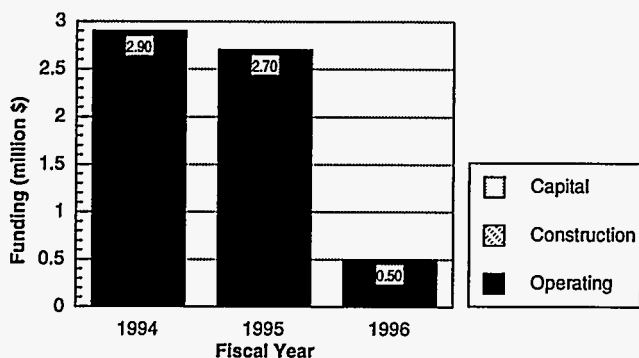
Mission Activity Description

Municipal solid wastes (MSW) present both an environmental threat to local communities and a largely untapped energy resource. Of the 250 million tons of solid wastes discarded to municipal waste facilities each year, less than 25 percent are used productively to generate electricity or used in new products after recycling. By using these wastes productively, the environmental impacts of municipal waste production on local communities will be greatly decreased and electricity can be generated without the use of additional fossil or nuclear resources. The estimated energy potential from productive use of MSW is 3 quads from power generation and 1.5 quads through material recycling. The MSW activity seeks to tap this potential by pursuing improved technologies for transforming waste to energy and by developing better information on waste recovery and recycling options. Accordingly, the MSW activity encompasses both applied R&D and data collection efforts:

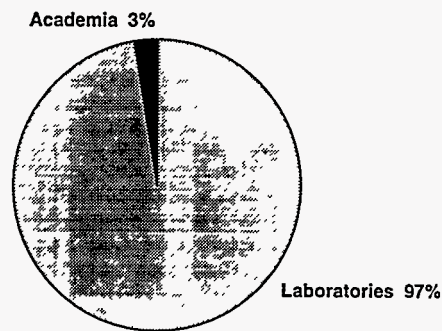
Applied Research and Development—Technology development has focused on co-combustion of sewage sludge, landfill gas utilization, and improved environmental controls for waste-to-energy plants (for example, reburn and lime injection to reduce acid gas emissions, and direct injection of chemicals to meet chlorine and sulfur emission levels).

Data Collection—Factual life-cycle data on waste-to-energy plants and recycling are collected to help decisionmakers and the public make informed decisions on various MSW disposal and utilization options.

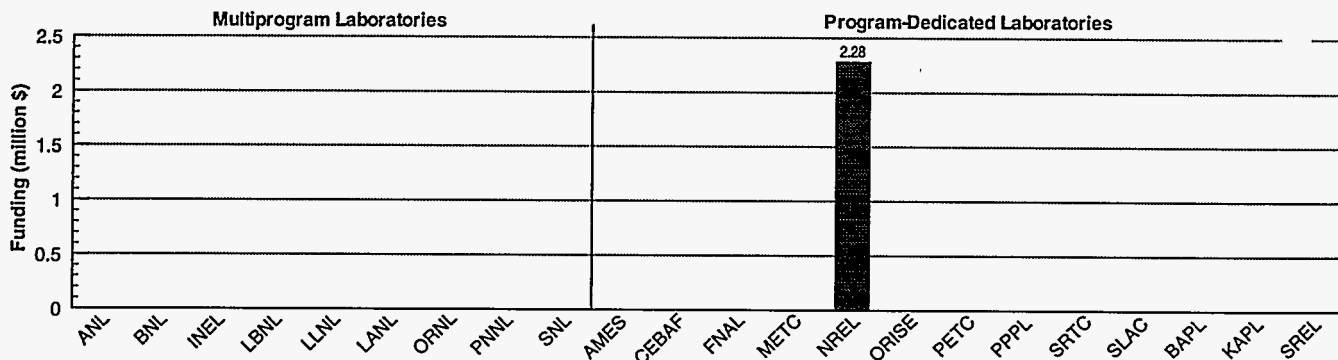
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Electric Motor Systems

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Industrial Technologies
Element: Industrial Processes
B&R Code: ED33

Laboratory Complex

Principal Laboratory: ORNL, NREL
Contributing Laboratories: None
Participating Laboratories: LBNL, PNNL

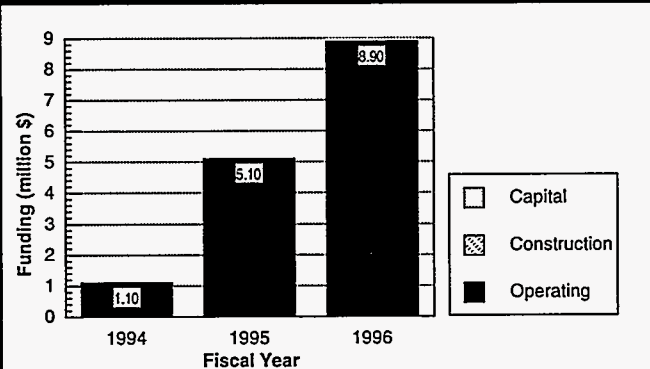
Mission Activity Description

Incremental improvements in the efficiency of motors, motor drive systems, and associated control technology can, when the best technology is implemented, have broad-based impacts across many industries in reducing electricity use and reducing production costs for U.S. industry. The Electric Motor Systems (EMS) activity serves the energy resources mission by providing technical and cost information to assist industry decisionmakers in electric motor system buying decisions. Purchasing decisions made today will affect the productivity and efficiency of industry for many years.

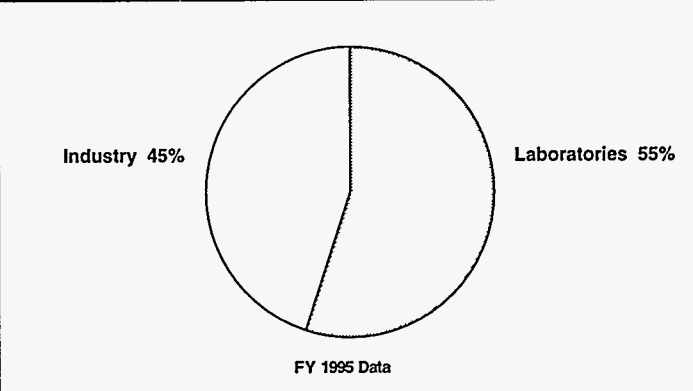
Motor Challenge, the centerpiece of the EMS activity, is a joint effort of DOE, industry, equipment manufacturers and distributors, and other interested parties to promote integrated systems of energy-efficient motors, adjustable speed drives, and energy-efficient motor-driven mechanical equipment and processes. Motor Challenge is recognized as representing a significant opportunity to enhance environmental performance and reduce energy consumption in U.S. industry.

The overall goal of the Motor Challenge initiative is to advance industry leadership and provide technical assistance and resources to industry so that firms will better understand, apply, and target energy-efficient EMS from a systems perspective. Motor Challenge consists of six program elements: (1) a Trade Ally program where suppliers, distributors, and utilities commit to work with Motor Challenge to assist the trade allies' clients to capture the benefits of energy-efficient motor systems; (2) an Excellence Partner program where industrial end-users commit to developing and implementing a plan to continually improve motor system management practices; (3) Showcase Demonstrations that involve industrial end-users leading teams that demonstrate and validate the costs and benefits of electric motor-driven system performance in varied settings and applications; (4) an information clearinghouse that disseminates reliable and timely information to thousands of industrial stakeholders; (5) market transformation initiatives that aim to encourage the market to offer new types of information, products, and services that will help end-users specify and capture energy-efficient motor systems more broadly and cost-effectively; and (6) market assessment and program evaluation activities that assist in understanding and characterizing the industrial motor systems market.

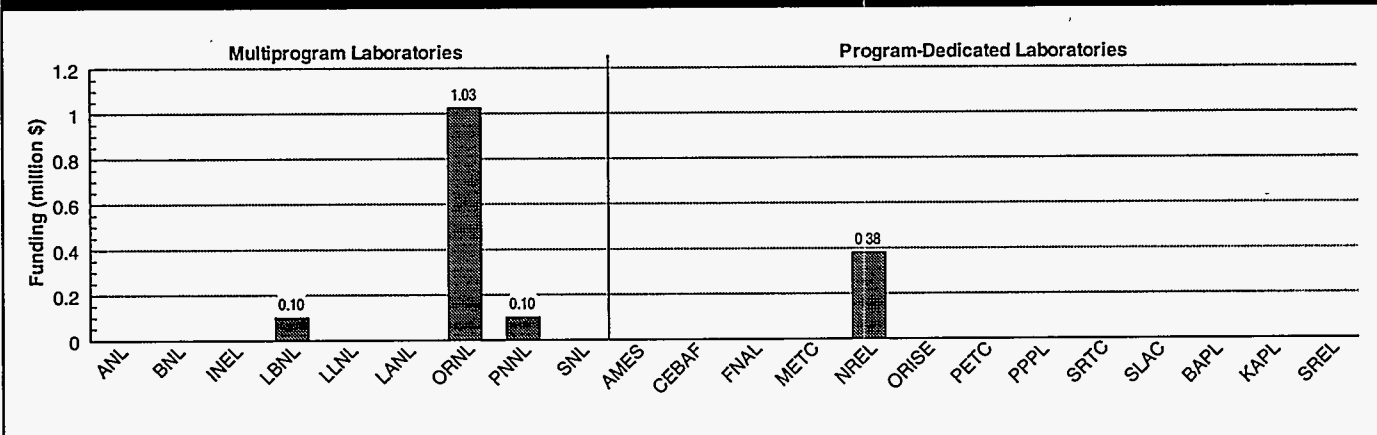
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Industrial Technologies Implementation and Deployment

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Industrial Technologies
Element: Waste Reduction Technologies
B&R Code: ED41

Laboratory Complex

Principal Laboratories: NREL
Contributing Laboratories: ANL, ORNL, PNNL
Participating Laboratories: INEL, LANL, ORISE, SNL

Mission Activity Description

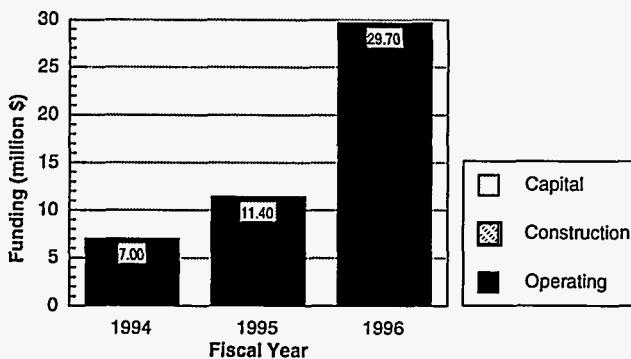
The mission of the Industrial Technologies Implementation and Deployment activity is to work with industry to create partnerships and channels for deploying energy-efficient technologies. The focus of these efforts are on the deployment of energy-efficient and waste-minimizing technologies for the most energy-intensive process industries. By improving the access to advanced energy-efficient technology, DOE can help U.S. industry to improve its energy productivity, increase its economic competitiveness, and improve its environmental performance. Technology Access currently consists of five elements: technology transfer and four partnership programs including Climate Wise, NICE³, Motor Challenge, and the Industrial Assessment Center (IAC) Program.

Technology Transfer—Cooperative programs are conducted with Power Marketing Administrations, utilities, industry, and trade associations to facilitate the successful transfer of assistance and information to industrial end-users of technology.

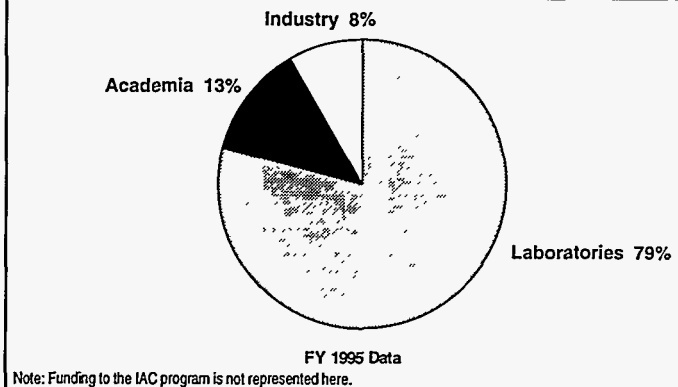
Climate Wise—Climate Wise is a voluntary program encouraging U.S. industry to take advantage of cost-effective energy-efficiency and pollution-prevention activities leading to greenhouse gas emissions reductions.

Industrial Assessment Center Program—The IAC Program, formerly the Energy Analysis and Diagnostic Center (EADC) Program, provides small and medium-sized manufacturing plants with no-cost industrial assessments that include energy audits and waste minimization assessments enabling facilities to become more energy efficient and to reduce energy costs.

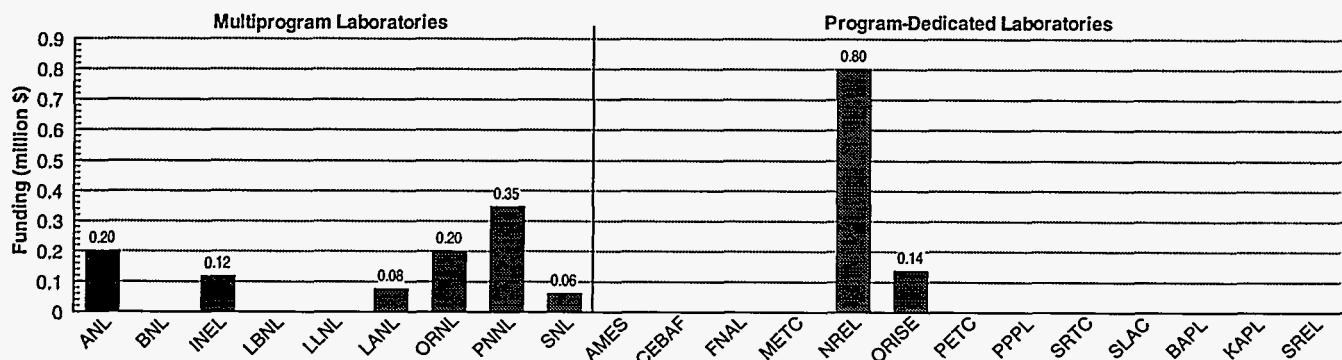
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Alternative Fuels Utilization

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Transportation Technologies
Element: Alternative Fuels
B&R Code: EE50

Laboratory Complex

Principal Laboratories: ORNL
Contributing Laboratories: None
Participating Laboratories: ANL, INEL, LLNL, SNL

Mission Activity Description

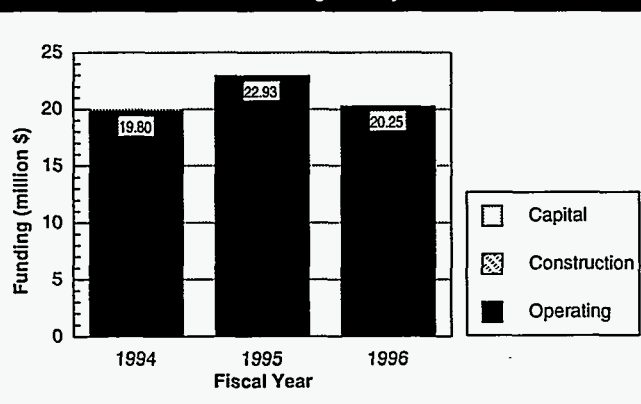
The Alternative Fuels Utilization Program was initiated in the mid-1970s under the authority of the Federal Non-Nuclear Energy Research and Development Act of 1974. The goal of the program was to support research and development activities to promote the use of alternative fuels in the transportation sector. During the first 14 years of this program it received a small amount of funds. The low funding levels allowed the program to maintain a minimal interest in the use of alternative fuels during this period. In 1988 a new piece of legislation, the Alternative Motor Fuels Act of 1988 (AMFA), was passed which strengthened the interest in these fuels by authorizing the Federal Government to demonstrate their use in the Federal fleet. AMFA also put mandates in place for use in Federal, State, and alternative-fuel provider fleets. An out-year conditional mandate was written into the act to allow Congress to require alternative-fuel use in all vehicles, based on information gathered on the Federal experience. In parallel, Congress increased funding levels on alternative-fuels research and development in order to develop the technology to commercially acceptable level. The Energy Policy Act of 1992 strengthened the Federal role by indefinitely extending authority to the Government to promote the widespread use and distribution of alternative fuels. The current program has evolved into three areas of focus:

Engine Optimization—The Engine Optimization subprogram is focused on research and development activities to advance the state of technology in transportation alternative-fuel use.

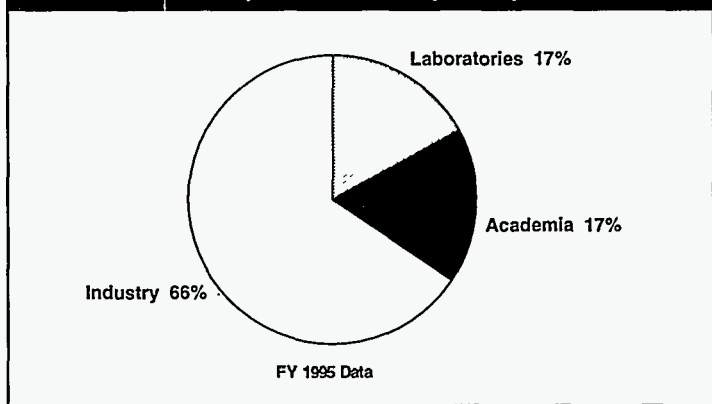
Fleet Test Demonstrations—Demonstration activities are conducted utilizing Federal, municipal, and private fleets. Performance, emissions, and durability data are collected on the alternative-fuel vehicles and compared with their petroleum-fueled counterparts.

Atmospheric Reactions—The objective of the Atmospheric Reactions subprogram is to assess the impact of alternative fuels on urban air quality relative to conventional transportation fuels.

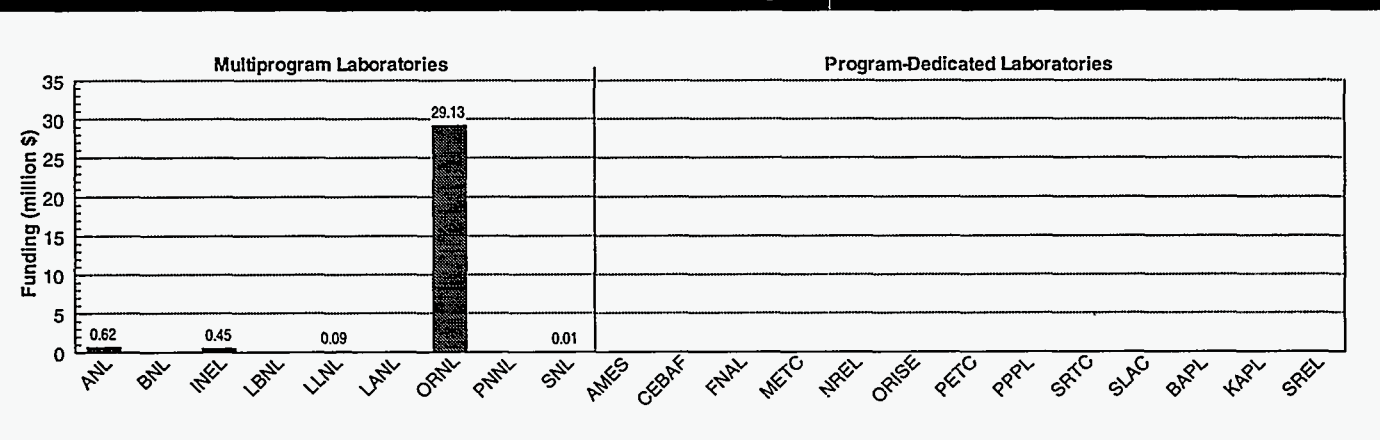
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Materials Technology

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Transportation Technologies
Element: Advanced Transportation Materials
B&R Code: EE51

Laboratory Complex

Principal Laboratories: ORNL
Contributing Laboratories: None
Participating Laboratories: ANL, INEL, LLNL, PNNL, SNL

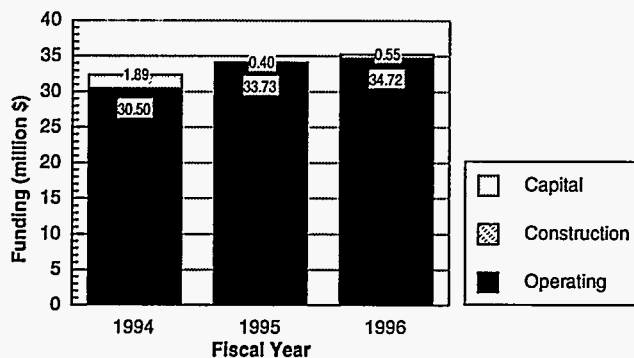
Mission Activity Description

Materials technology is the enabling technology for any conceivable conventional or advanced vehicle to achieve significantly higher fuel efficiency and reduced emissions, two of the Department of Energy's strategic goals. Timely availability of new, advanced materials having superior and reproducible properties and materials manufacturing technologies is critical for the development and engineering of advanced, fuel-efficient transportation systems which will result in the reduction of dependence on foreign petroleum, improving the balance of payments and increasing the gross domestic product, addressing two more strategic goals of the Department of energy. The materials R&D required for transportation vehicles falls into two categories:

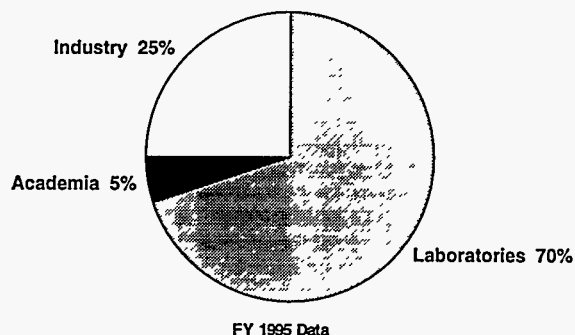
Propulsion System Materials—Ceramics are lighter than metals, can operate at much higher temperatures, and are wear resistant. These properties offer the potential over conventional materials to enable heat engines to operate more efficiently and reduce fuel consumption. The propulsion system materials subprogram supports development of high-temperature and wear-resistant ceramics for heat engine components.

Vehicle System Materials—Lightweight materials such as aluminum and magnesium alloys and polymer composites for vehicle chassis and body components will enable vehicle weight reduction and lead to improved overall fuel economy. The vehicle systems materials subprogram supports development of innovative, cost-effective forming processes for aluminum and magnesium alloys that can be used in domestic automobile production.

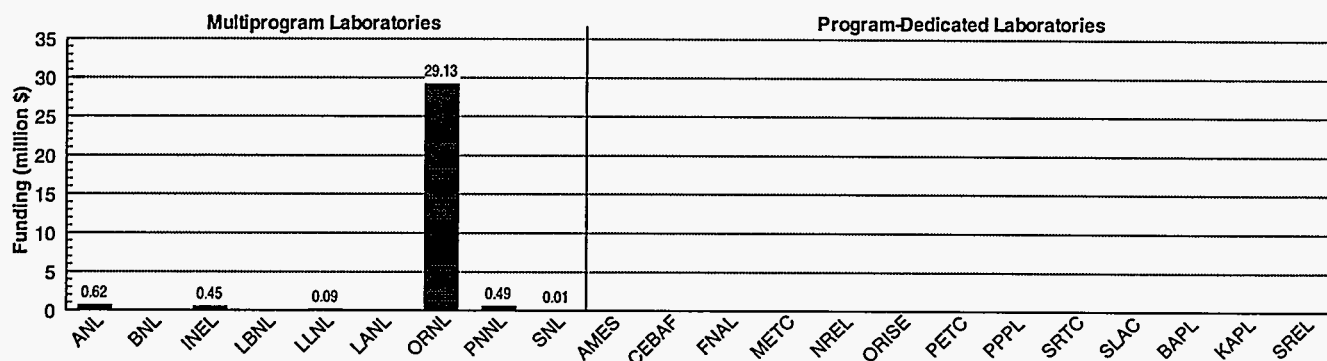
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Heat Engine Development

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Transportation Technologies
Element: Propulsion Systems
B&R Code: EE52

Laboratory Complex

Principal Laboratory: ANL, ORNL, PNNL, SNL
Contributing Laboratories: INEL, ORNL
Participating Laboratories: LANL, LLNL

Mission Activity Description

The Heat Engine Development activity is responsible for assisting industry and supporting government laboratory and university research in the development of advanced heat engine propulsion systems for highway vehicles. Development and commercialization of powertrain technology will assist the U.S. auto industry in meeting the upcoming statutory emission standards with improved fuel efficiency and in regaining market share lost to foreign competitors.

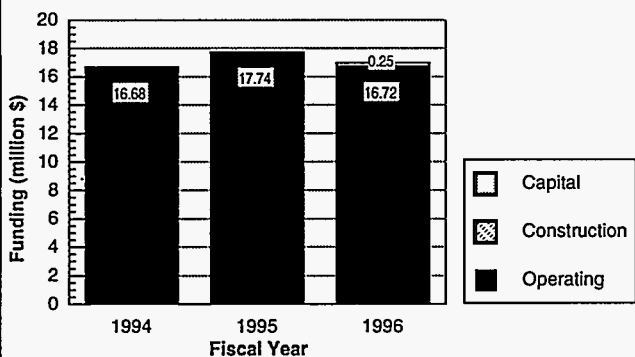
Turbine Engine Technologies—This subprogram supports the development of advanced technologies applicable to high-efficiency, ultra-low-emission, multifuel capable, turbo-alternator integrated power units for evaluation and possible future production of hybrid vehicles. This program is directed with the assistance of the NASA Lewis Research Center.

Automotive Piston Engine Technologies—Since its inception in FY 1994, the Automotive Piston Engine Technologies (APET) subprogram has provided a formal mechanism through which DOE-sponsored, conventional engine research and development (R&D) fulfills the requirements of the Energy Policy Act of 1992 (section 2022). APET also directly supports the goals of the Partnership for a New Generation of Vehicles Program by assisting the U.S. auto industry in cost-effectively meeting upcoming statutory emission standards without penalizing fuel efficiency.

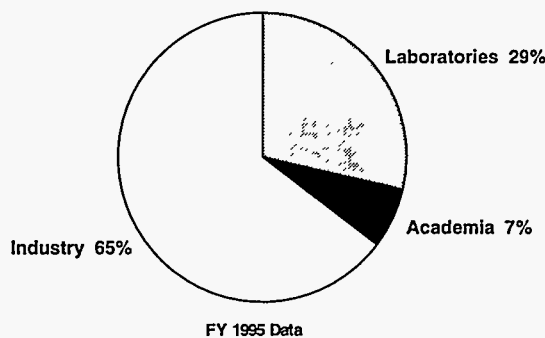
Combustion and Emissions Applied R&D—As a crosscutting effort, the Combustion and Emissions Applied Research and Development subprogram supports engine technology development efforts that are aimed at improving fuel efficiency, emissions reduction, and alternative fuel capability.

Heavy Duty (Diesel) Engine Technologies—R&D is carried out to accelerate the ability of the U.S. diesel engine manufacturers to meet Environmental Protection Agency 1998 and proposed future emission regulations, while ensuring the availability of viable technology to achieve improved efficiency in diesel engines with conventional and alternative fuel capability.

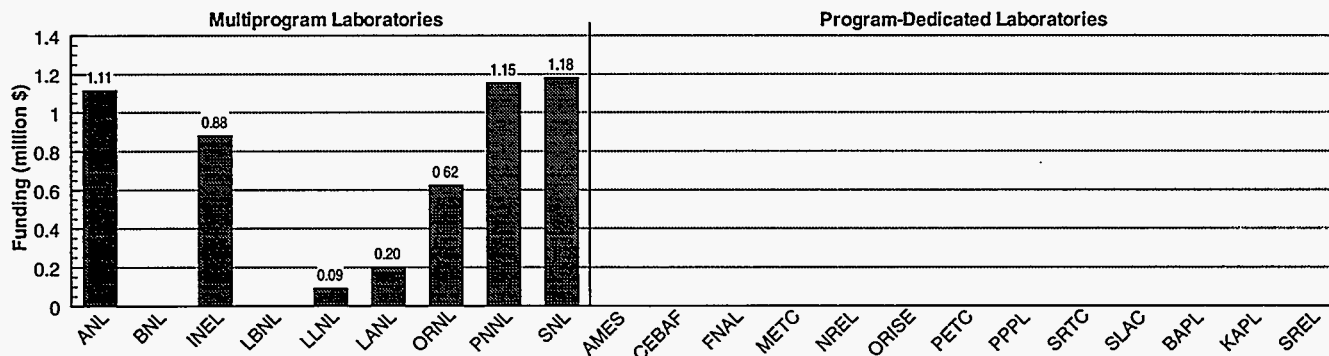
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Electric and Hybrid Propulsion Development

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
Office: Transportation Technologies
Element: Electric/Hybrid Propulsion
B&R Code: EE53

Laboratory Complex

Principal Laboratories: NREL, INEL
Contributing Laboratories: ANL, LBNL
Participating Laboratories: BNL, LLNL, ORNL, SNL

Mission Activity Description

The Electric and Hybrid Propulsion Development activity focuses on transportation technologies that will reduce our Nation's dependence on imported petroleum and improve the air quality in our urban areas. The program is concentrating on electric vehicles, fuel-cell-powered vehicles, and hybrid systems that utilize an electric drive in combination with a more conventional propulsion system. The work is cost shared with the automobile manufacturers and their supply industry. The Electric and Hybrid Propulsion Development Program consists of the four areas of activity described below.

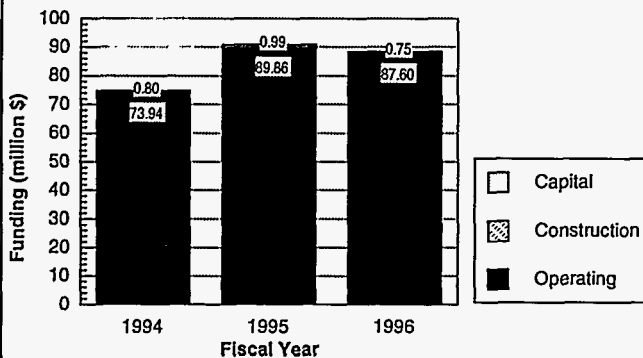
Electric Vehicle Research and Development—The Electric Vehicle Research and Development (R&D) subprogram supports the development of advanced electrochemical energy storage technologies that are required for the successful commercialization and broad public acceptance of electric vehicles as a transportation alternative to conventional internal combustion engine vehicles.

Hybrid Vehicle Research and Development—The Hybrid Vehicle R&D subprogram was initiated in FY 1993 as a 5-year, cost-shared cooperative effort with teams from General Motors and Ford. The primary objective is to complete the development of a production-feasible propulsion system by 1998.

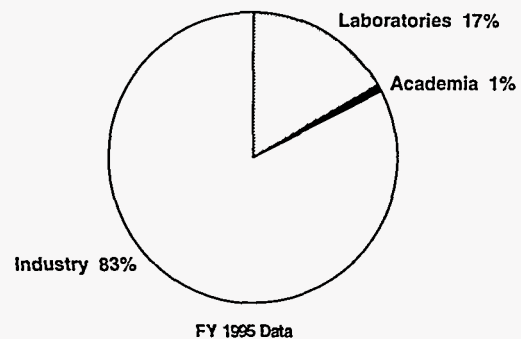
Fuel Cell Research and Development—The Fuel Cell R&D subprogram provides for the development of fuel cell propulsion systems as an alternative to internal combustion engines for the U.S. transportation sector.

Exploratory Technology Research—Exploratory technology research includes research on advanced batteries, ultracapacitors, and fuel cells for electric and hybrid-vehicle applications.

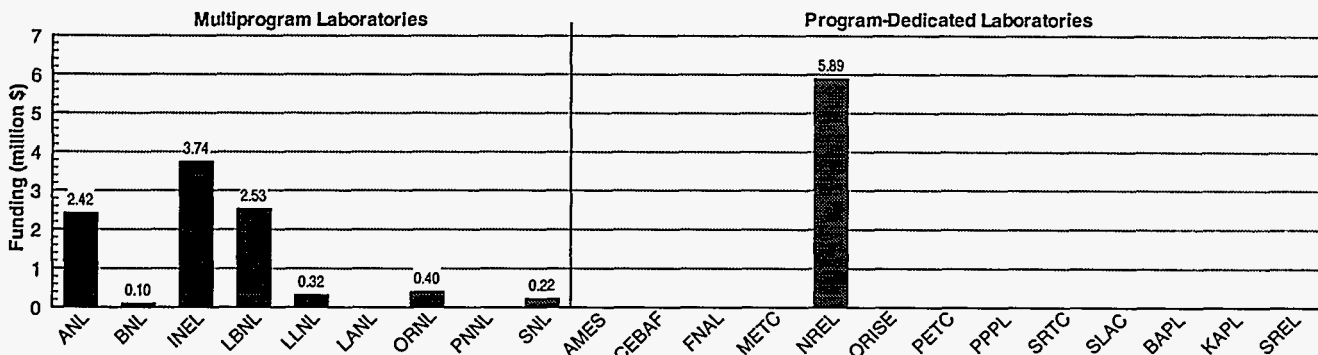
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Transportation Technologies Implementation and Deployment

Department of Energy Program

Program: Energy Efficiency and Renewable Energy
 Office: Transportation Technologies
 Element: Transportation Technologies
 B&R Code: EE54

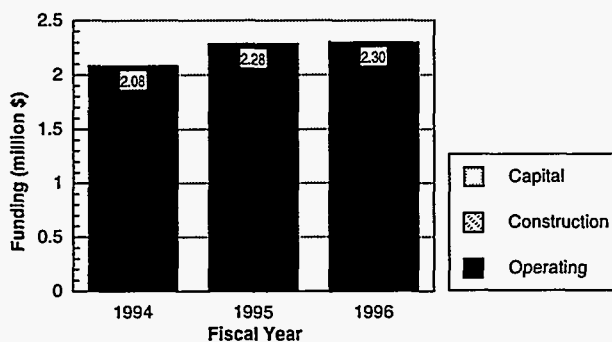
Laboratory Complex

Principal Laboratories: ANL
 Contributing Laboratories: ORNL
 Participating Laboratories: NREL

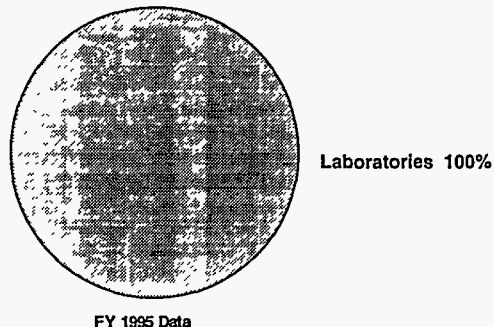
Mission Activity Description

The Implementation and Deployment activity develops and uses analytic tools to estimate the oil saving potential and social benefits of improved transportation technologies. This includes the characterization of technologies (cost and performance), the market potential of technologies, the resulting oil displacement, the emission reductions (both ambient and global), and the economic impacts (changes in employment and gross domestic product). Technology costs are estimated using program estimates, technical literature, cost accounting experts, and delphi studies. The market penetration is determined by using a vehicle choice model based on stated-preference data. The economic impacts are estimated by using a macroeconomic input-output model. A transportation energy data book is also produced each year for use by program managers, contractors, and other interested analysts.

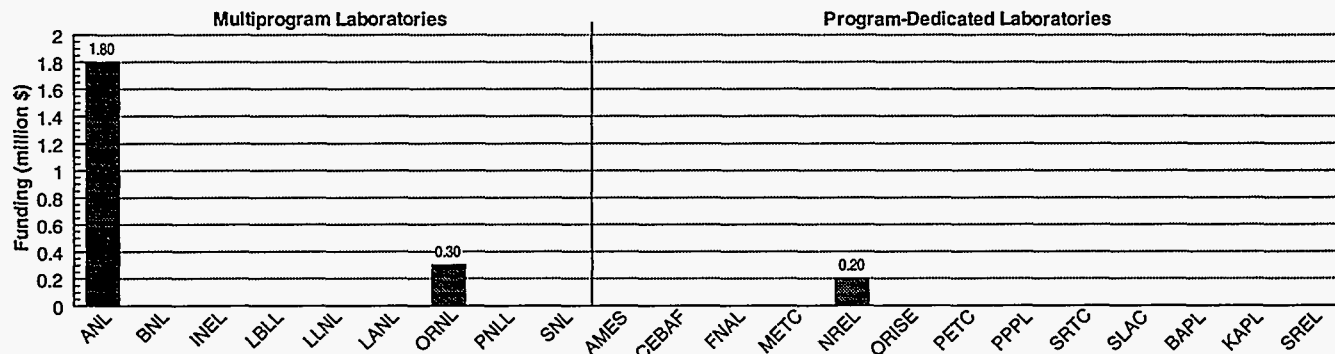
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Policy Planning and Analysis and Country Analyses

Department of Energy Program

Program: Policy
Office: Policy Planning and Analysis and Country Analyses
Element: Policy Planning and Analysis and Country Analyses
B&R Code: PE

Laboratory Complex

Principal Laboratories: None
Contributing Laboratories: None
Participating Laboratories: All

Mission Activity Description

Policy studies are conducted within the Office of Policy and its subordinate organizational elements. These studies and analyses serve a variety of cross-cutting Departmental functions.

Energy Policy—Analyze and recommend policy on economic, technical, environmental, and regulatory aspects of alternative fuels, oil, gas, renewables, energy efficiency, electric power generation, and energy utilization.

Economic and Environmental Policy—Analyze the economic and environmental impacts of various energy and related policies; perform studies on the energy-related aspects of global climate change and sustainable development; develop, maintain and refine various analytical information, data, tools and predictive models of energy and economic trends and activities that affect national energy supply, demand, and prices.

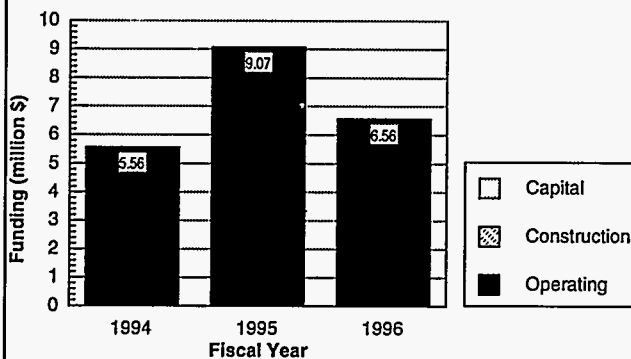
International Energy Policy—Direct and coordinate Departmental relations with other nations and with international organizations; monitor and analyze world energy market developments and the international, economic, political and strategic factors that affect those markets.

Science and Technology Policy—Analyze, develop and recommend crosscutting science and technology policies affecting Departmental activities in basic research; energy and related environmental technology research and development (R&D); export market analysis and development; and the national laboratories. Develop, maintain, and refine data and analytical tools to support science policy analysis

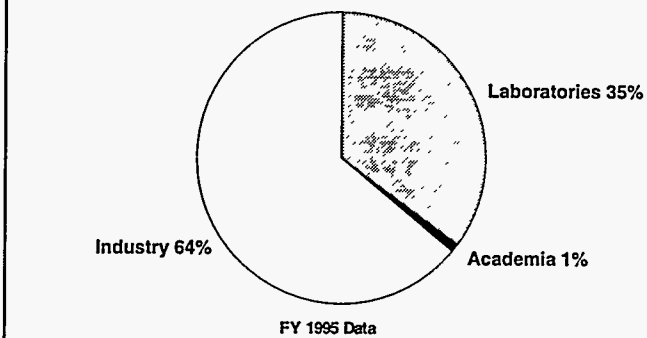
National Security and Environmental Restoration Policy—Formulate and recommend policies for DOE's defense, environmental restoration, safety and health, and emergency planning; analyze economic, financial, trade, and institutional factors that affect national security and related matters.

Strategic Planning and Programming—Develop, implement, and manage departmentwide strategic and multiyear planning; provide indepth technical and policy evaluation of the Department's program and budget priorities.

Funding History

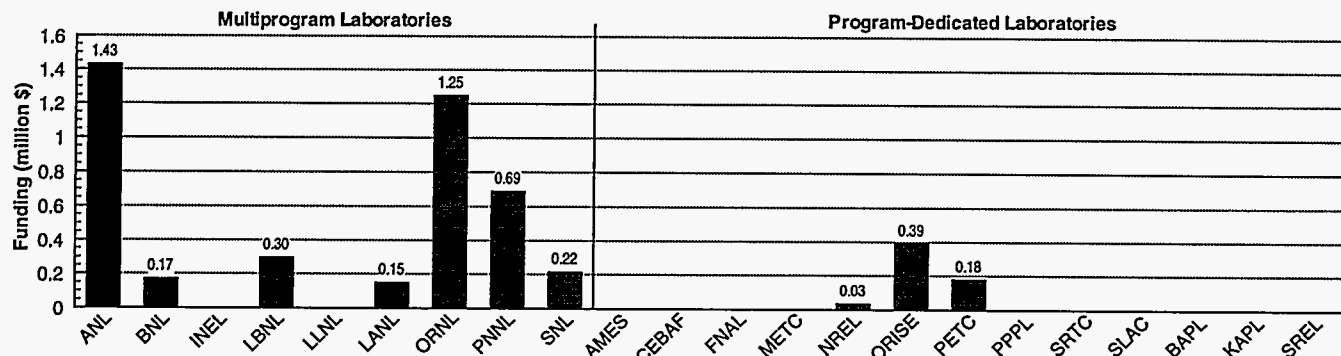


Laboratory-Academia-Industry Participation

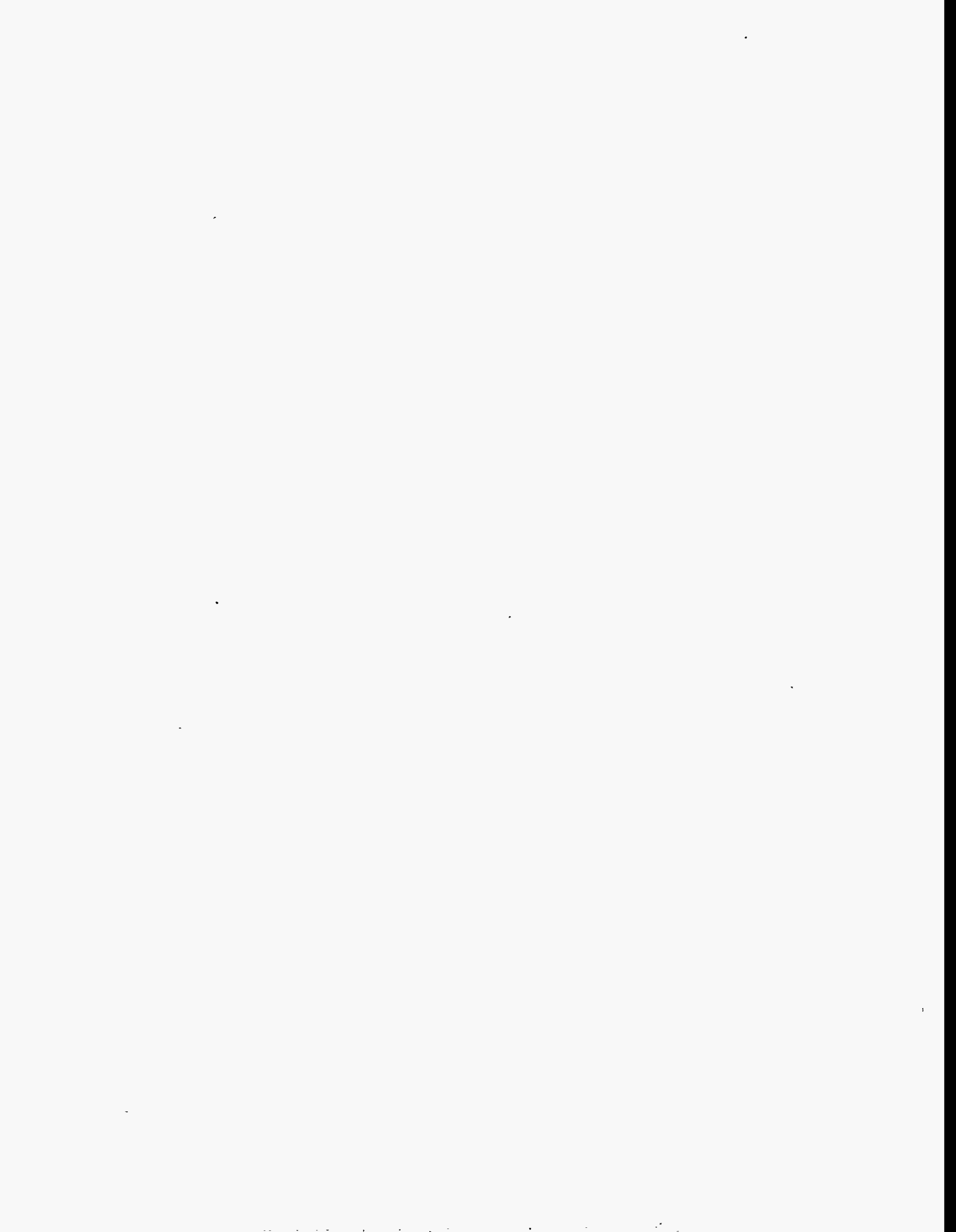


Note: Industry partition includes NAS, trade associations, and so forth.

Fiscal Year 1995 Funding Profile



Note: The DOE laboratories are utilized on an "as-needed" basis. Therefore all DOE laboratories are considered participating laboratories.



Yucca Mountain Site Characterization

Department of Energy Program

Program: Civilian Radioactive Waste Management
Office: Yucca Mountain Site Characterization
Element: Yucca Mountain Site Characterization
B&R Code: DB0102

Laboratory Complex

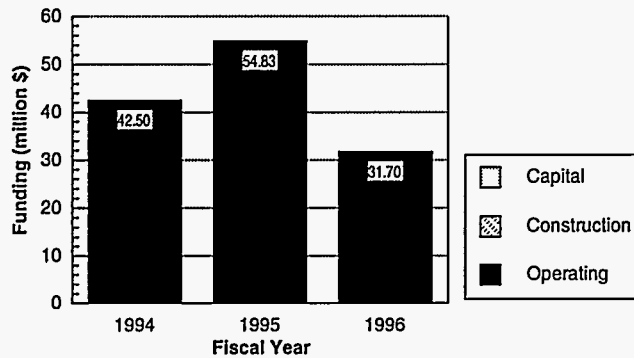
Principal Laboratories: LANL, LLNL, SNL
Contributing Laboratories: None
Participating Laboratories: LBNL, PNNL

Mission Activity Description

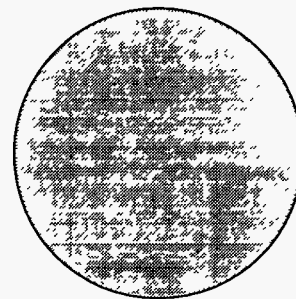
The Nuclear Waste Policy Amendments Act (NWPAA) of 1987 designated the Yucca Mountain Site for detailed investigation activities in order to evaluate its suitability to host a permanent geologic repository.

The mission of the Yucca Mountain Site Characterization activity is to determine the suitability of the Yucca Mountain Site as a permanent repository for the Nation's spent nuclear fuel and high-level defense nuclear waste; complete activities for presidential recommendation and license application submitted, and prepare and Environmental Impact Statement. Major activities include under ground excavation and tunneling related to the construction of the Exploratory Studies Facility (ESF), and well as underground testing in the ESF. Laboratory testing and design focus on activities that are necessary to support DOE decisions on the site suitability, site recommendation, and submittal of the license application.

Funding History



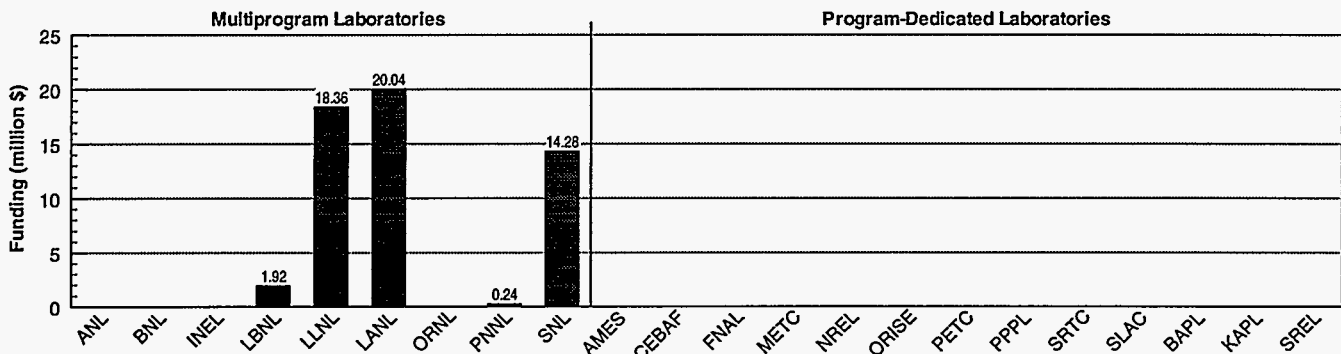
Laboratory-Academia-Industry Participation



Laboratories 100%

FY 1995 Data

Fiscal Year 1995 Funding Profile



Waste Acceptance, Storage, and Transportation

Department of Energy Program

Program: Civilian Radioactive Waste Management
 Office: Civilian Radioactive Waste Management
 Element: Waste Acceptance, Storage, and Transportation
 B&R Code: DB03

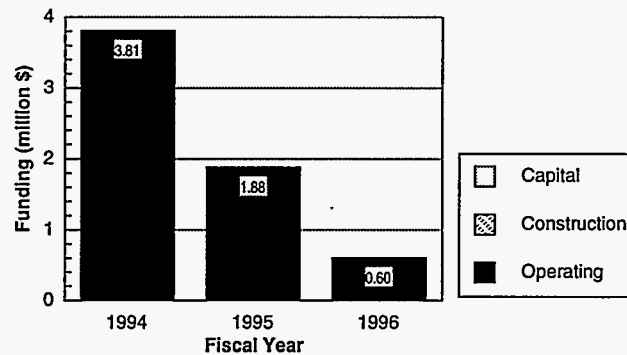
Laboratory Complex

Principal Laboratory: SNL
 Contributing Laboratories: None
 Participating Laboratories: ANL, LLNL, ORNL

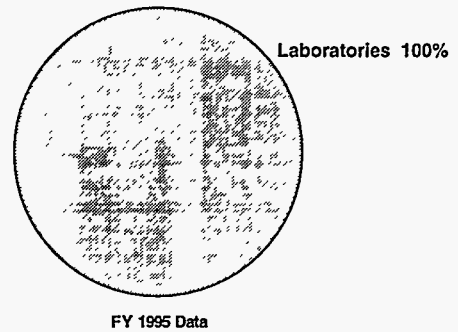
Mission Activity Description

The mission of the Waste Acceptance, Storage, and Transportation activity is to perform the long-lead-time requirements that precede near-term removal of spent nuclear fuel (SNF) from reactor sites once a Federal facility becomes available. This includes market-driven initiative to create the national transportation capability necessary to remove SNF by preparing contingency plans to award contractors to the private sector for canister, transport cask and storage module production, and waste acceptance and transportation services.

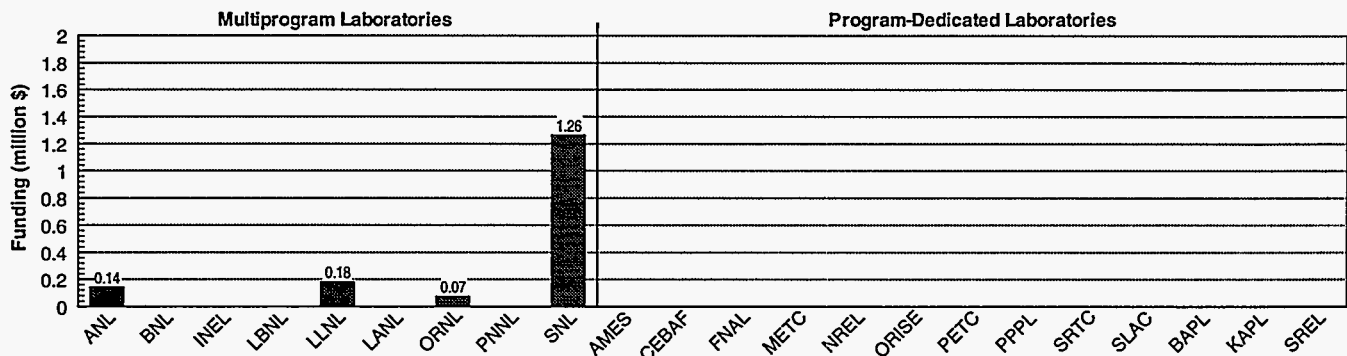
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Radioactive Waste Technical Program Support

Department of Energy Program

Program: Civilian Radioactive Waste Management
Office: Civilian Radioactive Waste Management
Element: Program Support
B&R Code: DB09

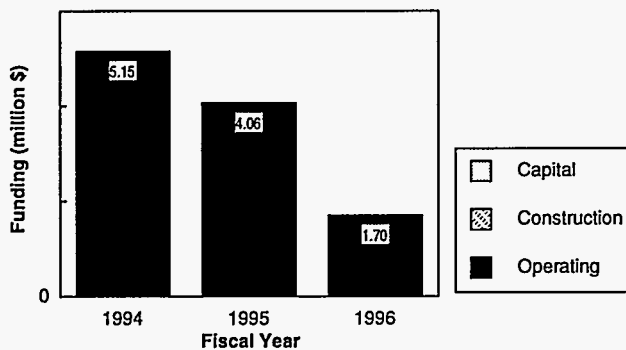
Laboratory Complex

Principal Laboratories: LBNL, LLNL
Contributing Laboratories: LANL, ORISE
Participating Laboratories: SNL

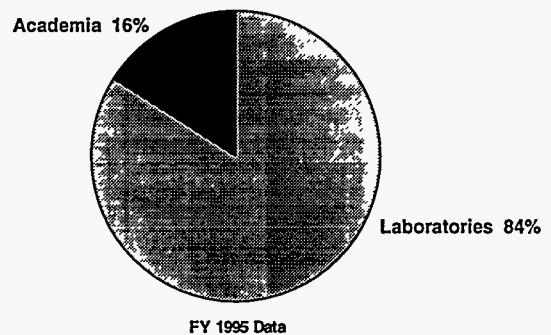
Mission Activity Description

The mission of Program Support in the Office of Civilian Radioactive Waste Management is to ensure the development of an integrated waste management system by facilitating integrated policy, programmatic, and resource decisions; communicating program policy and decisions; monitoring program performance, and ensuring implementation of federally mandated requirements for Nuclear Quality Assurance (QA) related to radiological health, safety and waste isolation.

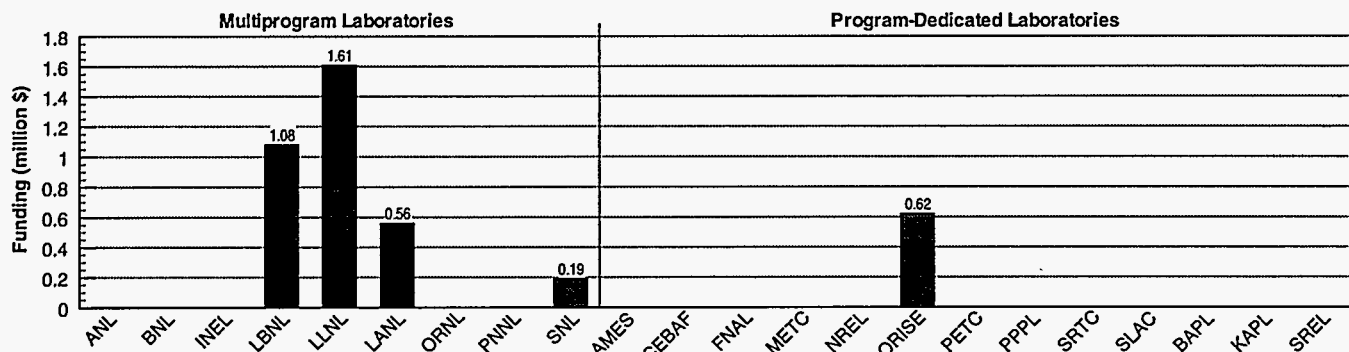
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Spent Fuel Research and Development

Department of Energy Program

Program: Civilian Radioactive Waste Management
 Office: Civilian Radioactive Waste Management
 Element: Spent Fuel Research and Development
 B&R Code: DC10

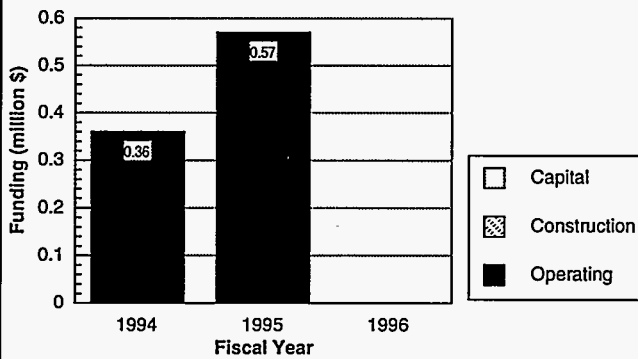
Laboratory Complex

Principal Laboratories: INEL, PNNL
 Contributing Laboratories: None
 Participating Laboratories: None

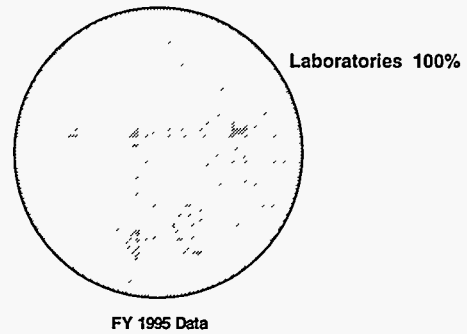
Mission Activity Description

The Spent Fuel Research and Development activity supports generic research and development (R&D) on alternative spent fuel storage technologies to enhance at-reactor storage capacity.

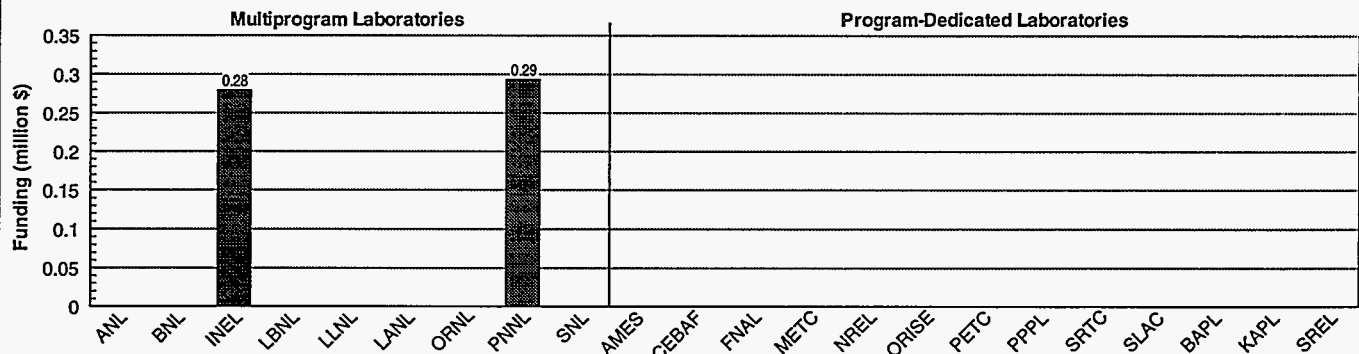
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Environmental Science and Technology Development

Department of Energy Program

Program: Environmental Management
Office: Technology Development
Element: Research and Development
B&R Code: EW40

Laboratory Complex

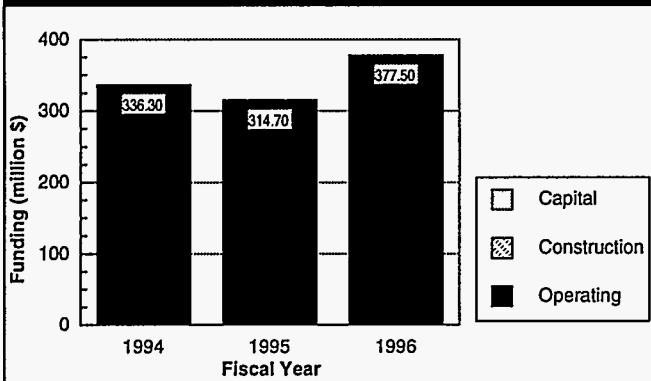
Principal Laboratory: INEL
Contributing Laboratories: ORNL, PNNL, SNL
Participating Laboratories: Ames, ANL, BNL, LANL, LBNL, LLNL

Mission Activity Description

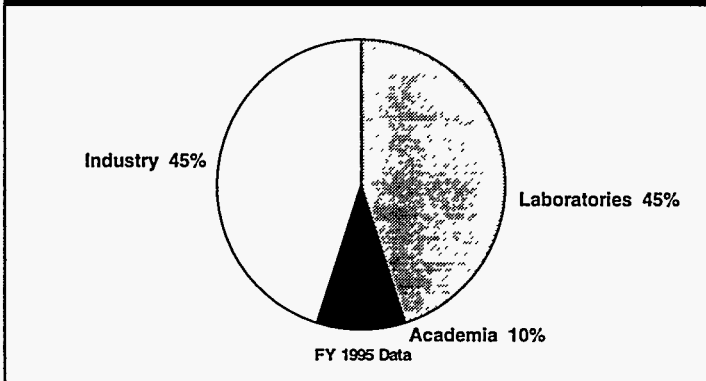
This activity focuses research and development on DOE's major environmental management issues, involving the best talent in DOE and in the national (public and private) science and engineering communities. Tasks involve development, demonstration, testing and evaluation of new technologies that are designed to meet critical DOE needs for alternative waste remediation methods, lower life-cycle waste remediation costs, and reduced risks to workers, local populations, and the environment. Focus areas are constructed around the major EM problem areas:

- Landfill Stabilization**—To address the migration and remediation challenges posed by DOE landfills;
 - Contaminant Plume Containment**—To address uncontained hazardous and radioactive contaminants in soil and groundwater;
 - Mixed Waste Characterization, Treatment, and Disposal**—To manage hazardous, low-level and transuranic radioactivity contamination;
 - High Level Waste Tank Remediation**—To address the large quantity of storage tanks containing over 100 million gallons of radioactive waste;
 - Decontamination and Decommissioning**—To transition, decommission, deactivate, and dispose of aging/contaminated DOE weapons complex facilities.
- The following crosscutting tasks support all focus areas:
- Efficient Separations**—To develop technologies to extract radionuclides to reduce waste volume, saving in disposition costs;
 - Characterization, Monitoring, and Sensors**—To develop systems to accurately characterize, monitor, and analyze wastes;
 - Robotics**—To reduce worker risk by way of remotely controlled robotic systems;
 - Technology Integration**—To involve external entities (sites, users, public, tribes, regulators, private industry, universities) in innovative technical solutions.

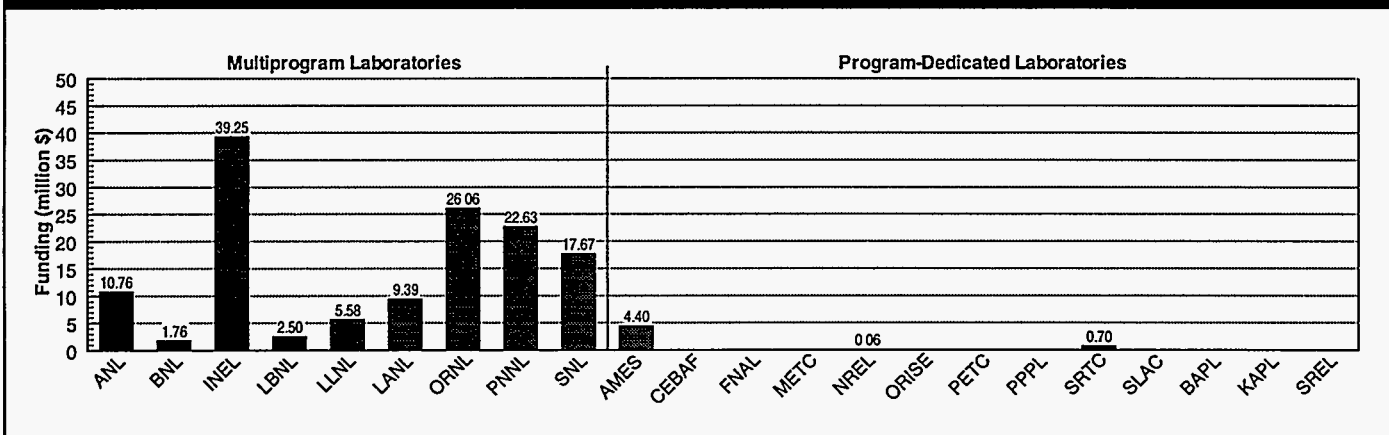
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Waste Management Technology Development

Department of Energy Program

Program: Environmental Management
Office: Waste Management
Element: Research and Development
B&R Code: EW31

Laboratory Complex

Principal Laboratory: PNNL
Contributing Laboratories: INEL, LLNL
Participating Laboratories: ANL, LANL, ORNL, SRTC

Mission Activity Description

The Waste Management Program has strategic and tactical technology development needs that are outside the EM Office of Science and Technology's funding capabilities and mission. Waste Management technology development activities are primarily directed toward satisfying compliance agreements and regulatory requirements. Technology development activities are typically site, waste process, and waste operations specific. This activity focuses on six areas:

Base Program—Responsible for maintaining a safe storage configuration and acceptable short term risks for all wastes.

High Level Waste Program Area—Responsible for treatment and disposal of approximately 400,000 m³ of HLW (the base program is responsible for storage). The national strategy is to solidify all high level waste for disposal in a geologic repository.

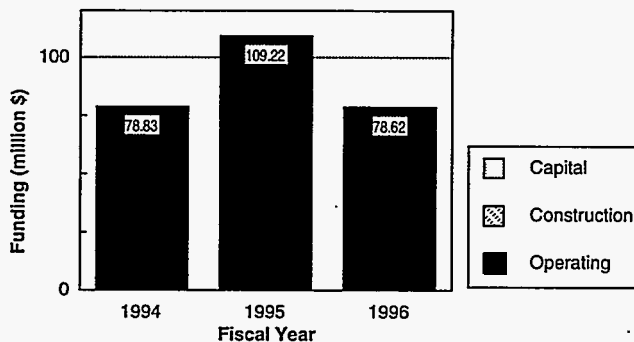
Transuranic Waste Area—Manages the isolation, characterization, treatment (if necessary), and disposal of all TRU waste. The national strategy is to permanently emplace all defense TRU Waste in a geologic repository (Waste Isolation Pilot Plant).

Mixed Low-Level Waste Area—Responsible for the characterization, treatment, and disposal of MLLW. Treatment strategies and options are in accordance with consent orders signed with affected states under the Federal Facility Compliance Act of 1992.

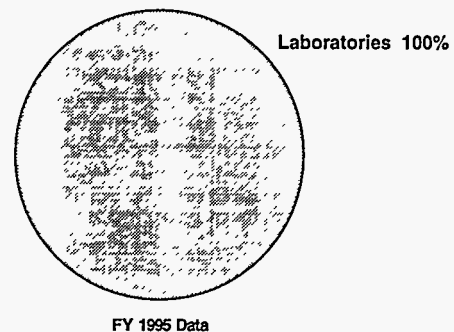
Low-Level Waste Area—Manages treatment and disposal of LLW stored and generated across the complex.

Hazardous Waste Area—Integrates site hazardous waste management programs. Hazardous waste is highly regulated and management options are limited. Sites rely primarily on commercial vendors for treatment and disposal of hazardous waste.

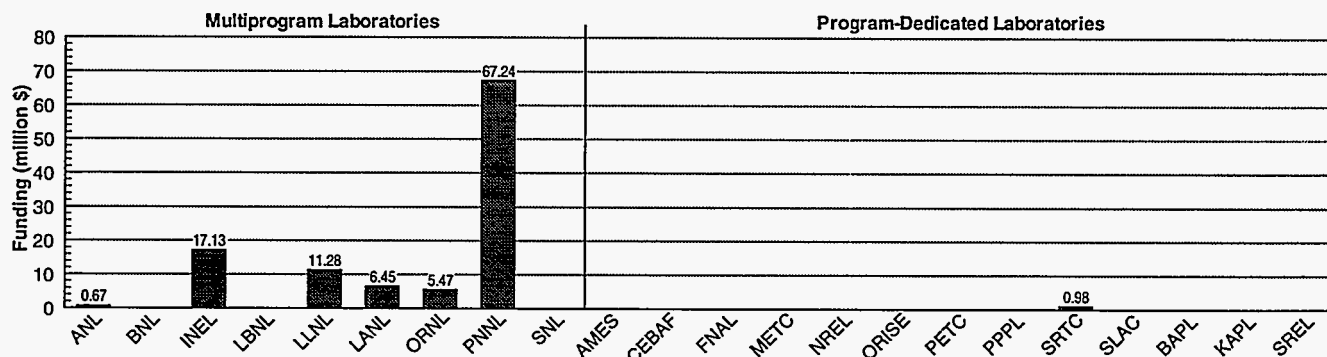
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Field Site Technical Support

Department of Energy Program

Program: Environmental Management
 Office: Waste Management
 Element: Waste Management
 B&R Code: EW315501, EX33

Laboratory Complex

Principal Laboratories: SNL
 Contributing Laboratories: None
 Participating Laboratories: ANL, BNL, INEL, LANL, LLNL, ORNL, PNNL

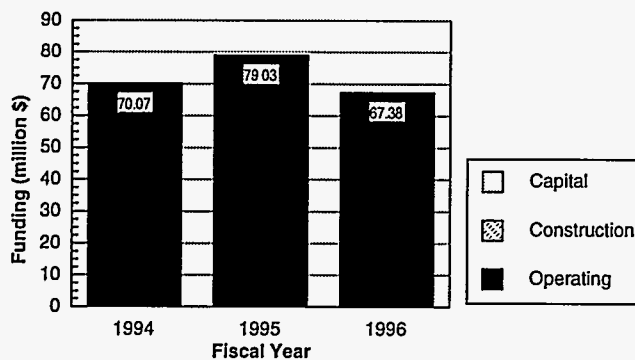
Mission Activity Description

Field site technical support activities address waste management processes carried out through site waste programs. Examples of field site technical support activities include: (1) technical analyses, modeling, and engineering studies related to waste characterization, packaging, transportation, treatment, storage, and disposal; (2) risk assessment studies; and (3) technical program planning activities. Current field site support tasks are the Waste Isolation Pilot Plant, New Mexico, and the West Valley Demonstration Project, New York.

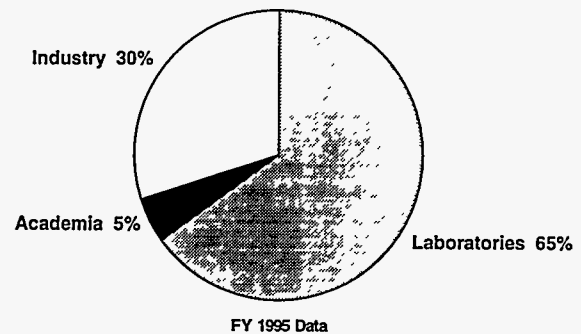
Waste Isolation Pilot Plant (WIPP)—The Waste Isolation Pilot Plant provides a research and development facility to determine the suitability of the site for the safe disposal of defense-related transuranic mixed waste. Technical support includes development of computer codes and performance assessment calculations; geohydrology and geochemical studies; geomechanics and shaft sealing studies.

West Valley Demonstration Project—The West Valley Demonstration Project is intended to demonstrate safe immobilization using vitrification of liquid high-level radioactive waste produced at the site. Technical support activities include glass testing and studies to support waste acceptance, processing of laboratory samples, and fabrication, characterization, and product consistency testing of radioactive glass.

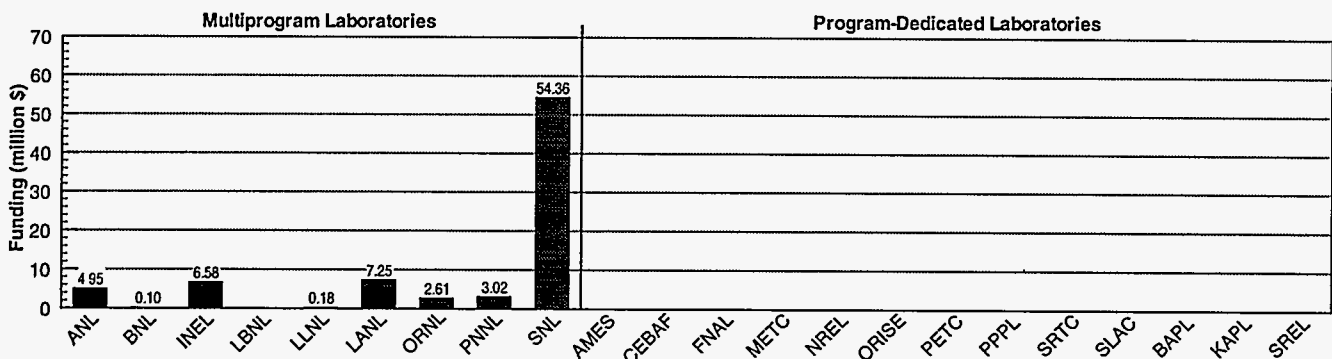
Funding History

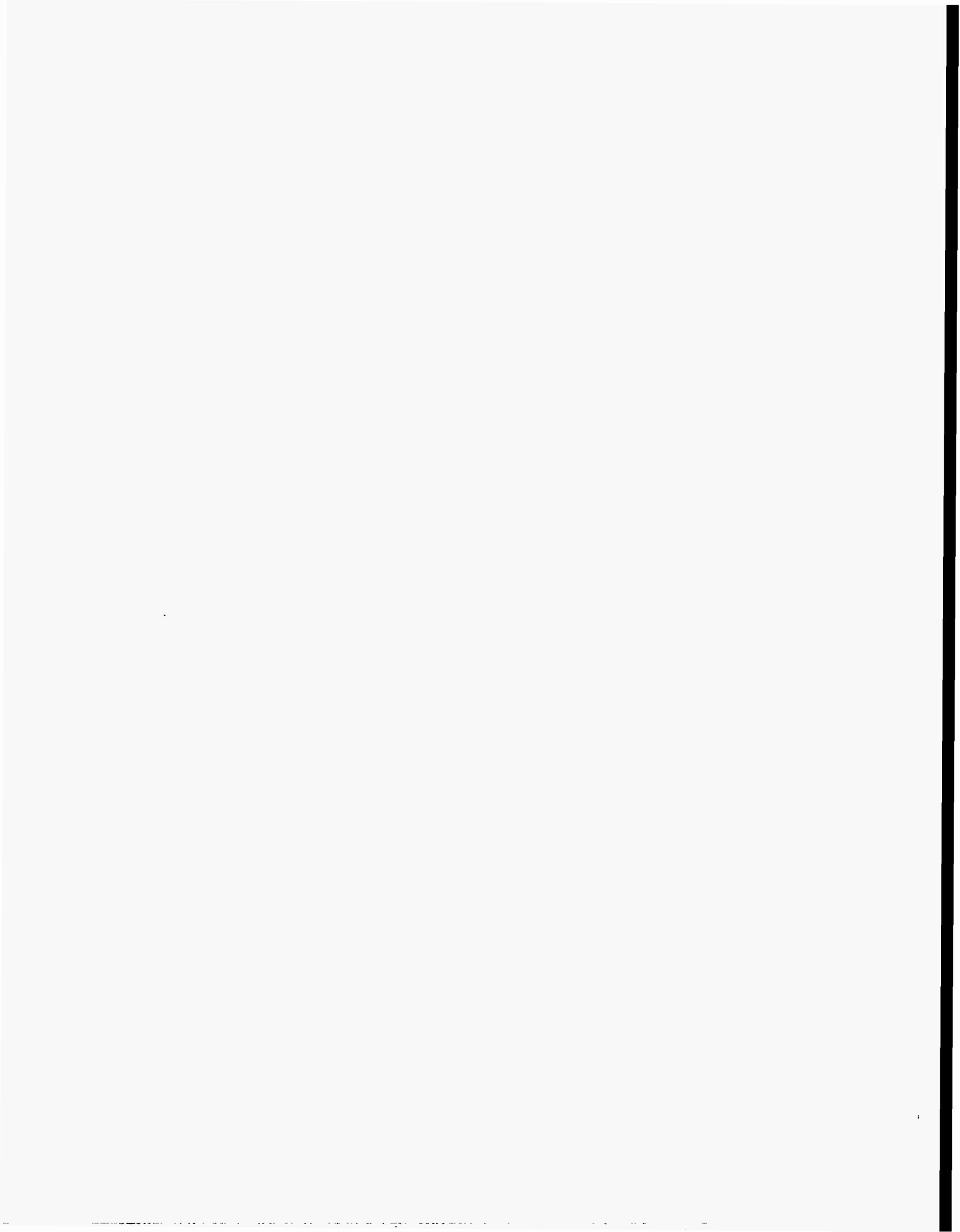


Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile





Metallurgy and Ceramics

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Material Sciences
 B&R Code: KC0201

Laboratory Complex

Principal Laboratories:
 Contributing Laboratories: Ames, ANL, LBNL, ORNL, SNL
 Participating Laboratories: BNL, INEL, LANL, LLNL, NREL, ORISE, PNNL

Mission Activity Description

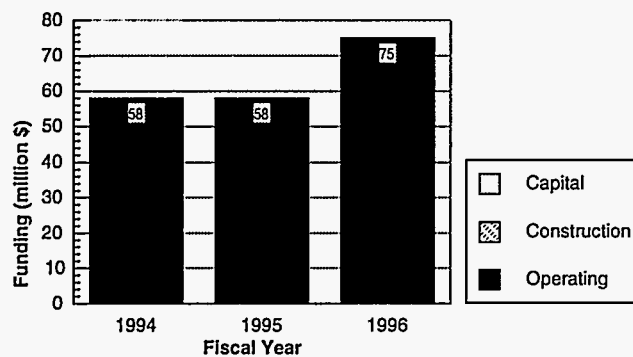
Material Sciences supports basic research for the development of technologies for the efficient production and use of energy. Every technology is materials limited, and new materials can lead to new energy, automotive, and environmental technologies and markets.

Material Sciences enables 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. Research in material sciences is concerned with optimizing the behavior and performance of these technologies. This research seeks to understand the synthesis, processing, structure, properties, and behavior of materials to discover new technological capabilities.

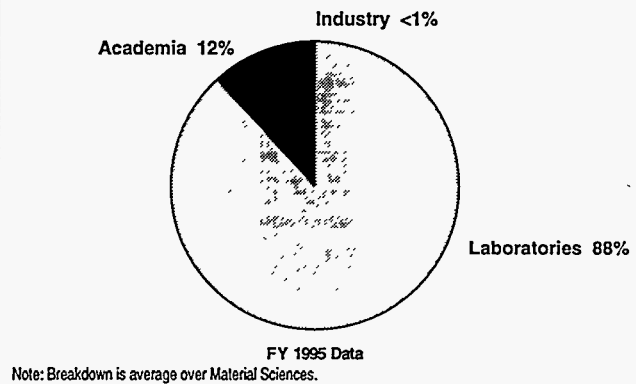
Material Sciences supports the operation of unique facilities that are not otherwise available to the scientific community and their application to energy-related materials problems.

The metallurgy and ceramics research area of material sciences investigates the synthesis, processing, structure, and properties of metals and ceramics for energy, environmental, and automotive needs. Research thrusts are aimed at improving safety and reliable performance of materials. For example, surface modifications reduce friction and wear, modelling of near-net shape fabrication processes reduces the cost and improves the performance of complex materials systems, and new methods for welding and joining of metal and ceramic materials open up new technological opportunities, including service in radiation, high-temperature, and corrosive and erosive environments and for solar and photovoltaic applications. Manufacturing processes are improved by nondestructive evaluation monitoring and other applications of new instrumentation.

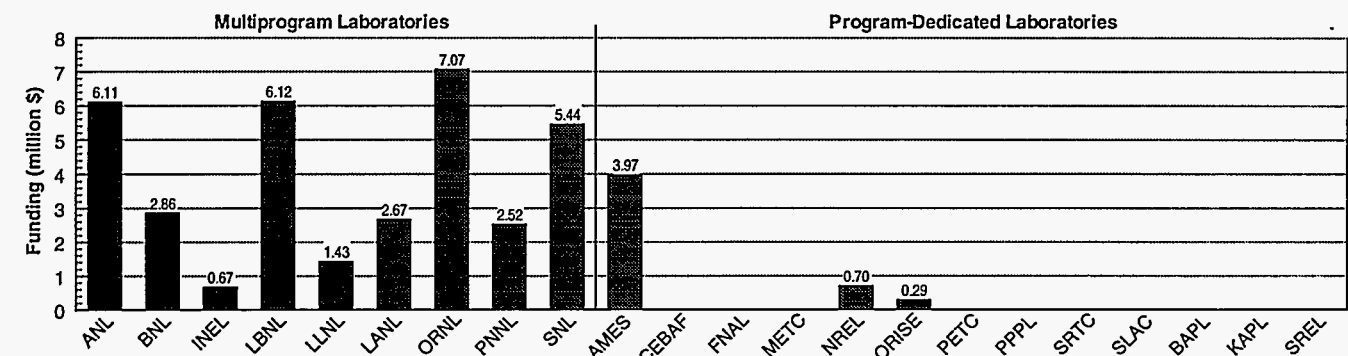
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Solid-State Physics

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Material Sciences
 B&R Code: KC0202

Laboratory Complex

Principal Laboratories: ORNL
 Contributing Laboratories: ANL, BNL, LBNL
 Participating Laboratories: AMES, INEL, LANL, LLNL, NREL, PNNL, SNL

Mission Activity Description

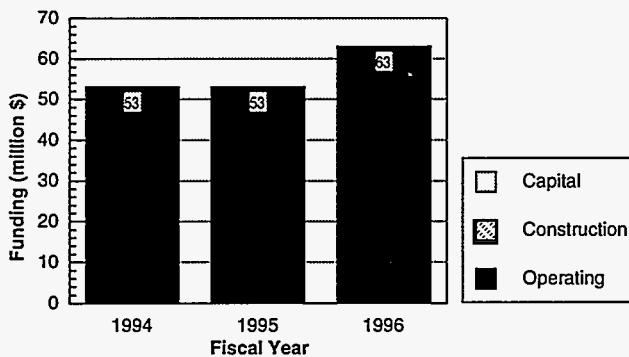
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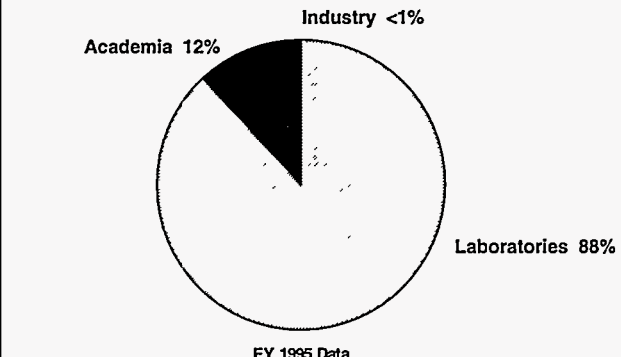
Material Sciences supports the operation of unique facilities that are not otherwise available to the scientific community and their application to energy-related materials problems.

The solid-state physics research area focuses on advancing understanding of materials properties by use of synchrotron radiation and neutron scattering, thus enabling the exploration of materials properties that could be accomplished by no other means. Specific thrusts focus on the energy-related properties of materials, including understanding the physics of high-temperature superconductivity; the physics of surfaces and interfaces; development of novel characterization methods; and magnetic, photonic, and photovoltaic materials, and related instrumentation.

Funding History

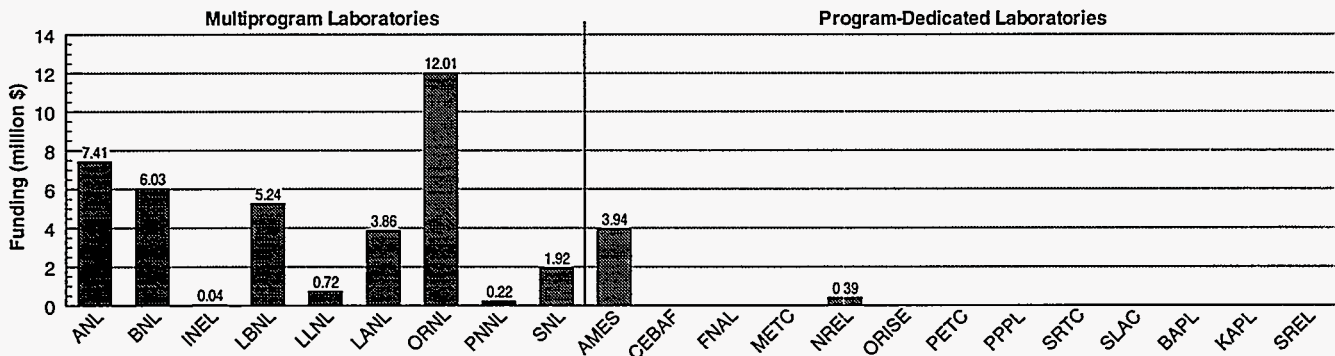


Laboratory-Academia-Industry Participation



Note: Breakdown is average over Material Sciences.

Fiscal Year 1995 Funding Profile



Materials Chemistry

Department of Energy Program

Program: Energy Research
Office: Basic Energy Sciences
Element: Material Sciences
B&R Code: KC0203

Laboratory Complex

Principal Laboratories: ANL, LBNL
Contributing Laboratories: Ames, ORNL
Participating Laboratories: BNL, INEL, LANL, LLNL, PNNL, SNL

Mission Activity Description

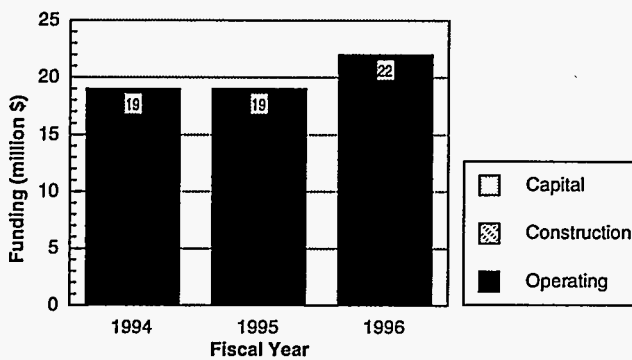
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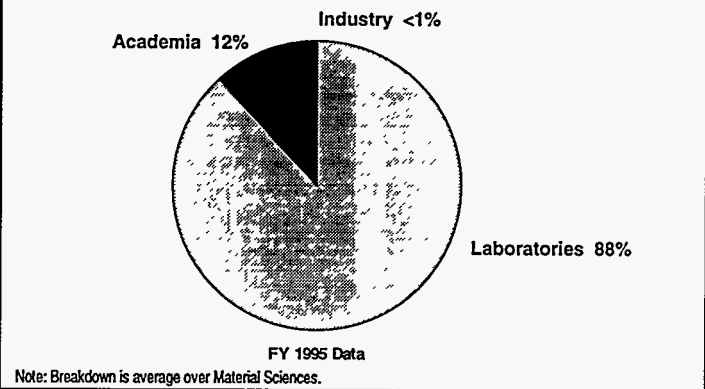
Material Sciences supports the operation of unique facilities that are not otherwise available to the scientific community and their application to energy-related materials problems.

The materials chemistry research area focuses on synthesis, processing, and characterization of polymers, organic ferromagnets, fullerene derivatives, nanocluster materials, and organic and inorganic superconductors. Each of these types of materials has the potential for profoundly advancing energy-related and other technologies. The surface chemistry component of the effort addresses corrosion, electrochemistry, and the molecular understanding and control of lubrication and friction.

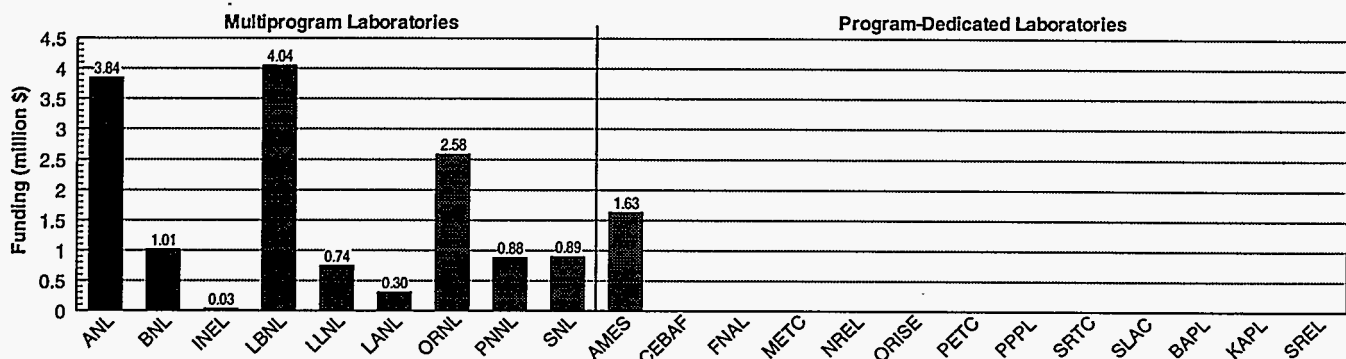
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Materials Sciences Facilities Operations

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Materials Sciences
 B&R Code: KC0204

Laboratory Complex

Principal Laboratories: ANL
 Contributing Laboratories: BNL, LBNL
 Participating Laboratories: ORNL, SLAC

Mission Activity Description

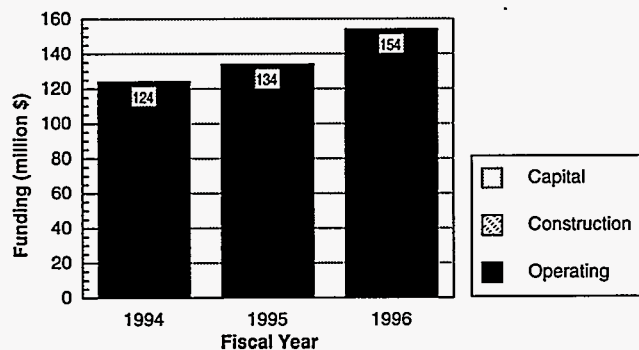
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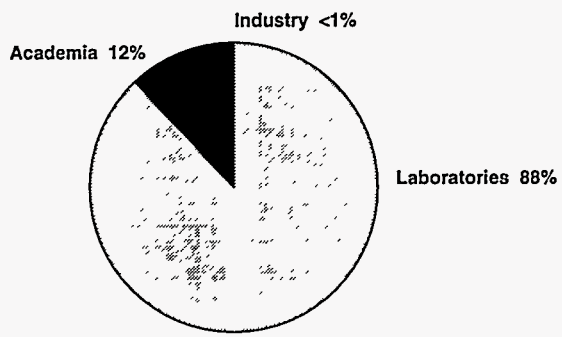
Materials Sciences supports the operation of unique facilities that are not otherwise available to the scientific community and their application to energy related materials problems.

The facilities operation area supports the major facilities used to conduct forefront research in materials and other disciplines and in the applied sciences using high fluxes of neutrons or photons. These facilities are unique in their ability to probe materials structure and properties important to energy related phenomena. Recognizing the unmatched opportunity for scientific advances, scientists from all parts of the Nation travel to these facilities to conduct their research. In 1996, final commissioning of the 6-7 GeV Synchrotron Radiation Source will take place and the operations of the Manuel Lujan, Jr., Neutron Scattering Center will be restored.

Funding History

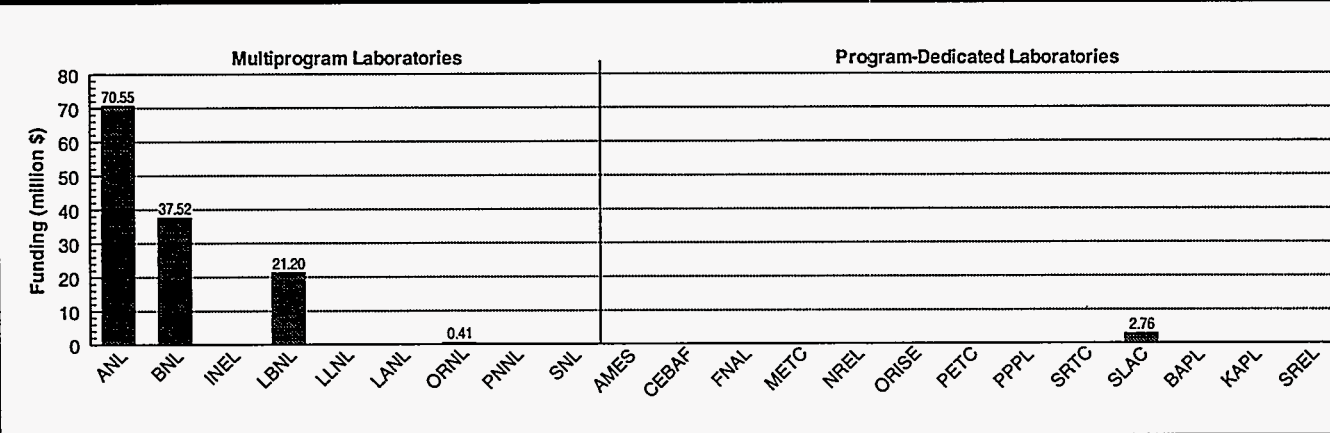


Laboratory-Academia-Industry Participation



FY 1995 Data
 Note: Breakdown is average over Materials Sciences.

Fiscal Year 1995 Funding Profile



Photochemical and Radiation Sciences

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Chemical Sciences
 B&R Code: KC030101

Laboratory Complex

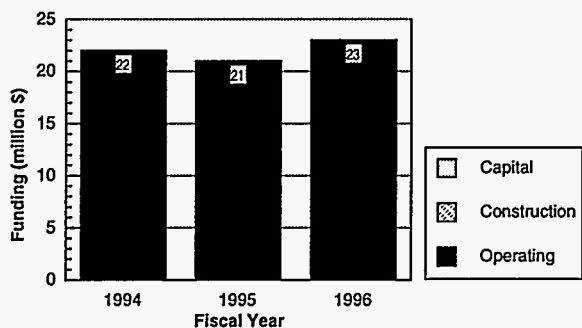
Principal Laboratories: ANL, BNL
 Contributing Laboratories: NREL
 Participating Laboratories: Ames, LBNL, LLNL, ORISE

Mission Activity Description

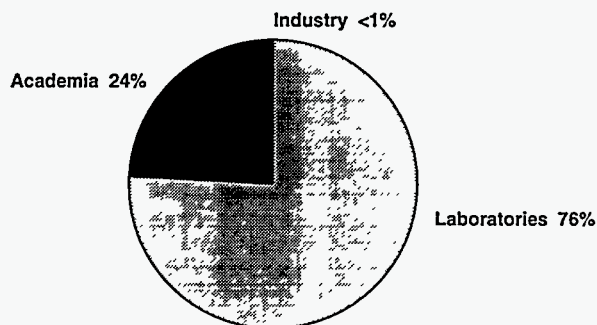
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The primary goal of the photochemical and radiation sciences area is to support basic research that will lead to improved devices for the conversion of solar radiant energy into electricity or fuels. Areas of research emphasis that contribute to this 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 of this research are directly tied to development of sustainable technologies based on solar and renewable energy sources. In addition, the radiation sciences research program has been and continues to be invaluable for understanding how and what is occurring in complex radiant environments like those encountered in waste tanks at Hanford and elsewhere.

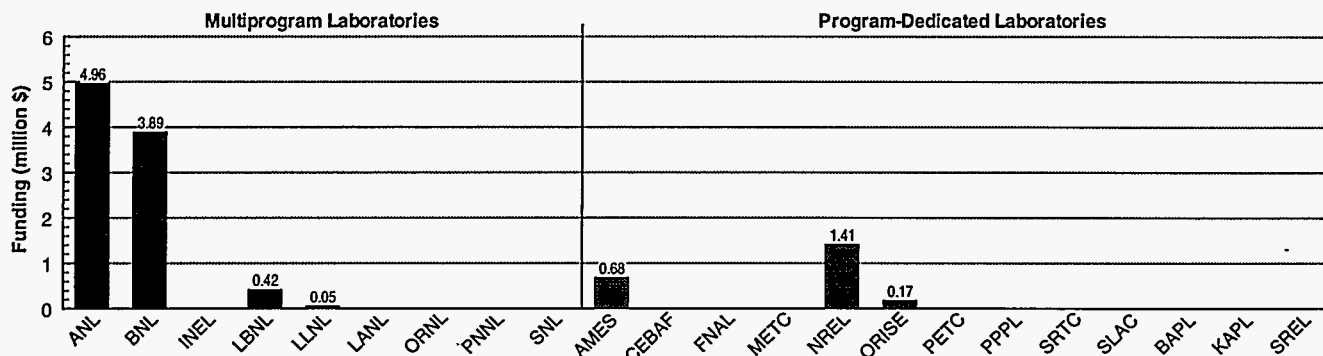
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Chemical Physics

Department of Energy Program

Program: Energy Research
Office: Basic Energy Sciences
Element: Chemical Sciences
B&R Code: KC030102

Laboratory Complex

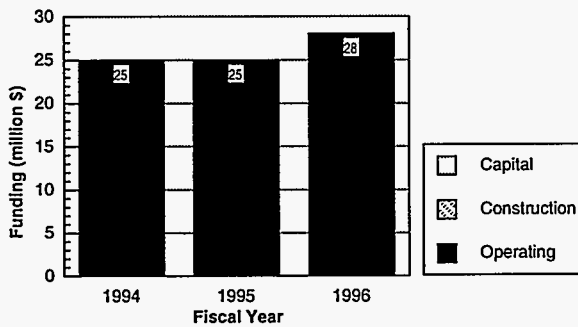
Principal Laboratories: ANL, PNNL
Contributing Laboratories: BNL, LBNL, SNL
Participating Laboratories: Ames, ORNL, LLNL

Mission Activity Description

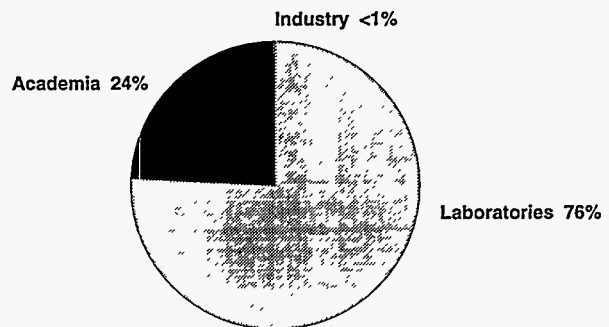
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The Chemical Physics research area focuses on combustion and catalysis related research. Combustion processes account for about 90 percent of the energy generated today. To reduce the environmental effects of combustion processes, they must be made 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 focuses 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.

Funding History

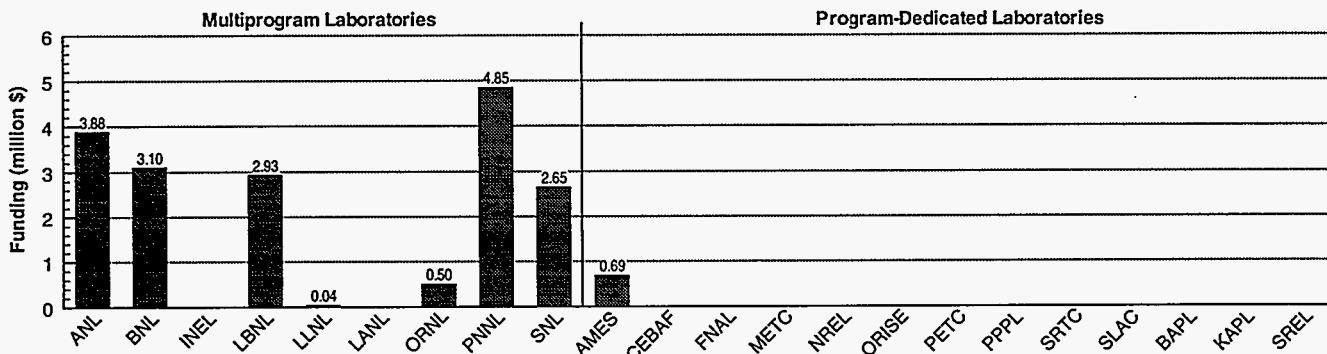


Laboratory-Academia-Industry Participation



FY 1995 Data
 Note: Breakdown is average over Chemical Sciences.

Fiscal Year 1995 Funding Profile



Atomic Physics

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Chemical Sciences
 B&R Code: KC030103

Laboratory Complex

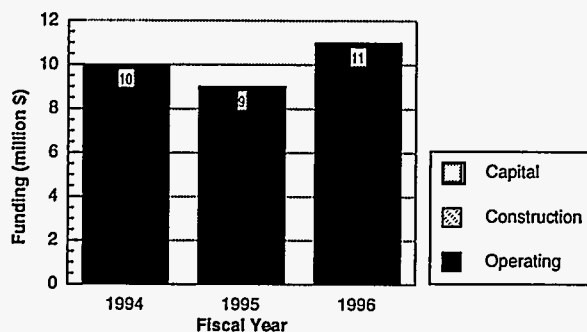
Principal Laboratories: ANL, LBNL, ORNL
 Contributing Laboratories: None
 Participating Laboratories: LLNL, BNL

Mission Activity Description

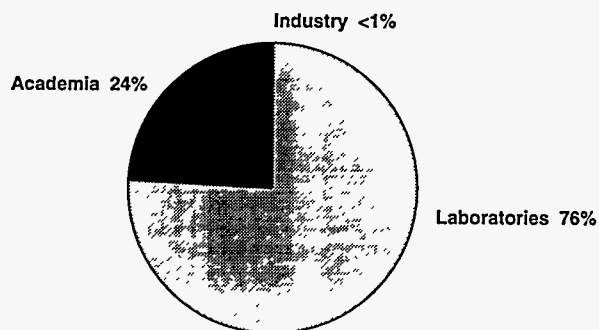
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The atomic physics research area focuses on plasmas and energetic species associated with plasmas. For example, highly ionized heavy atoms are important to the advancement of fusion concepts. The systems under study also include low-temperature plasmas relevant to a host of modern technologies including materials processing and lighting.

Funding History

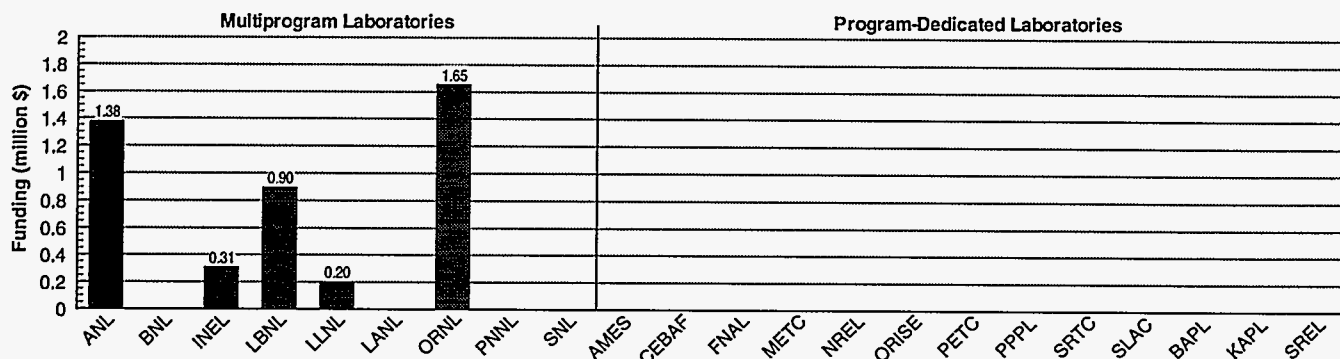


Laboratory-Academia-Industry Participation



FY 1995 Data
 Note: Breakdown is average over Chemical Sciences.

Fiscal Year 1995 Funding Profile



Chemical Sciences Facilities Operations

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Chemical Sciences
 B&R Code: KC030104

Laboratory Complex

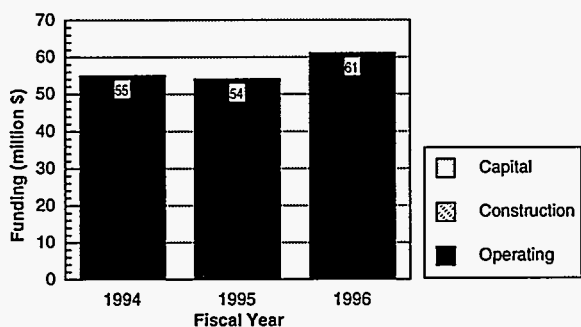
Principal Laboratories: ORNL, SLAC
 Contributing Laboratories: BNL
 Participating Laboratories: SNL

Mission Activity Description

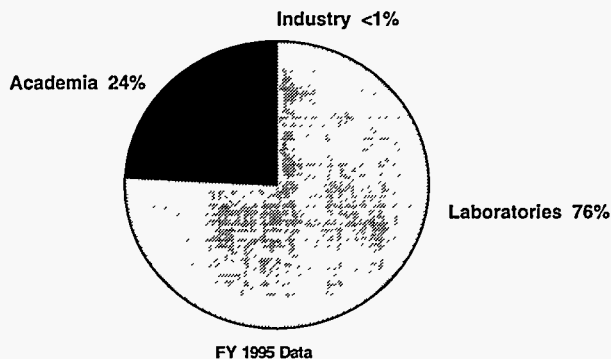
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Chemical Sciences Facilities Operations supports major user facilities which are open to all qualified researchers and offer the opportunity to explore chemical systems using instruments and capabilities available nowhere else. Such facilities include the Combustion Research Facility at Sandia, Livermore; the High Flux Isotope Reactor at Oak Ridge; and the synchrotrons at both Brookhaven and Stanford. These large instruments represent resources for the general scientific community to expand the frontiers of science by applying tools of unmatched capability.

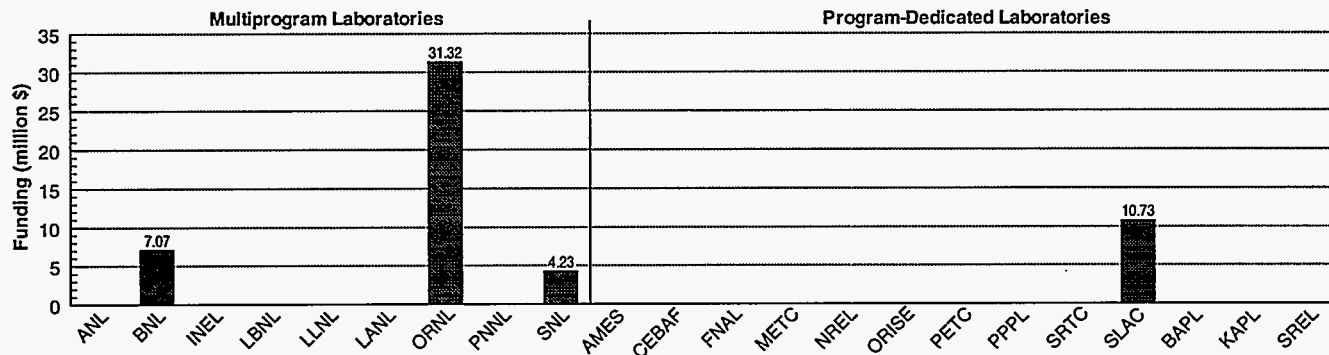
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Chemical Energy

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Chemical Sciences
 B&R Code: KC030201

Laboratory Complex

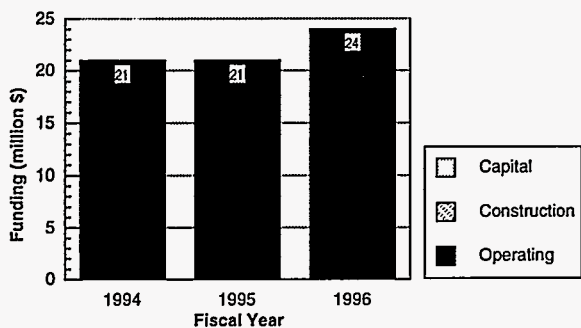
Principal Laboratories: ANL, ORNL
 Contributing Laboratories: BNL
 Participating Laboratories: Ames, LANL, LBNL, NREL, PETC, PNNL

Mission Activity Description

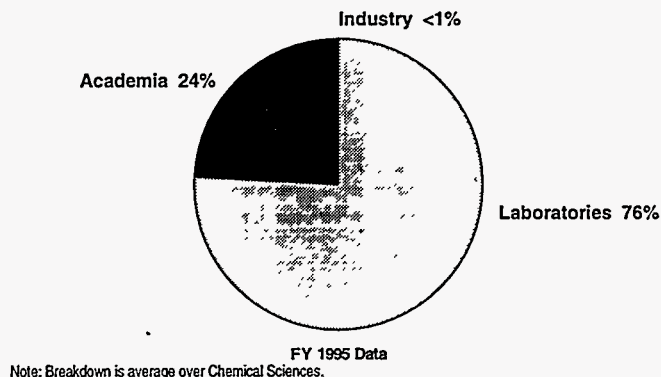
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The two main efforts under the Chemical Energy research area are the catalysis related research program and chemistry important to development of better ways to utilize carbonaceous resources such as natural gas, oil, coal and biomass. Research in 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. Studies of chemical transformations and/or conversions to new or existing concepts of energy production and storage are a prime focus.

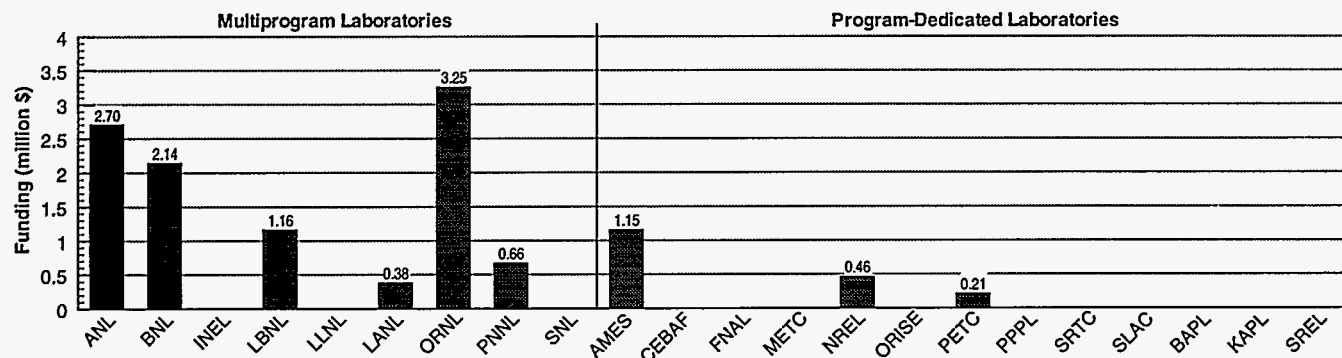
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Chemical Separations and Analysis

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Chemical Sciences
 B&R Code: KC030202

Laboratory Complex

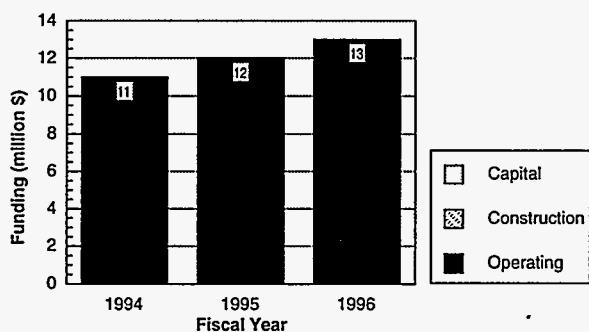
Principal Laboratories: ORNL
 Contributing Laboratories: Ames, ANL, PNNL
 Participating Laboratories: BNL, INEL, LBNL

Mission Activity Description

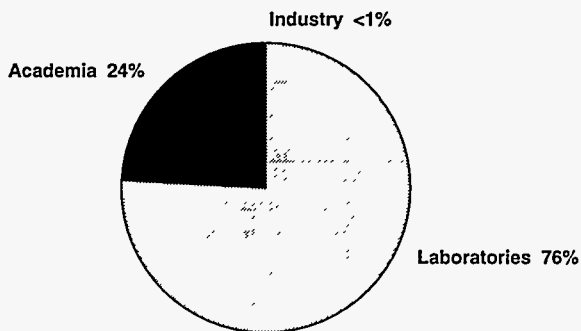
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The Separations and Analysis research area is particularly important to processes being developed for remediation of contaminated environmental systems and waste. More efficient separations processes are sought through the use of selective membranes and design of molecular systems for species-specific separations. Analytical chemistry research focuses on sensitive, reliable and species-specific ways to identify and monitor the constituents of contaminated systems and waste. 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.

Funding History

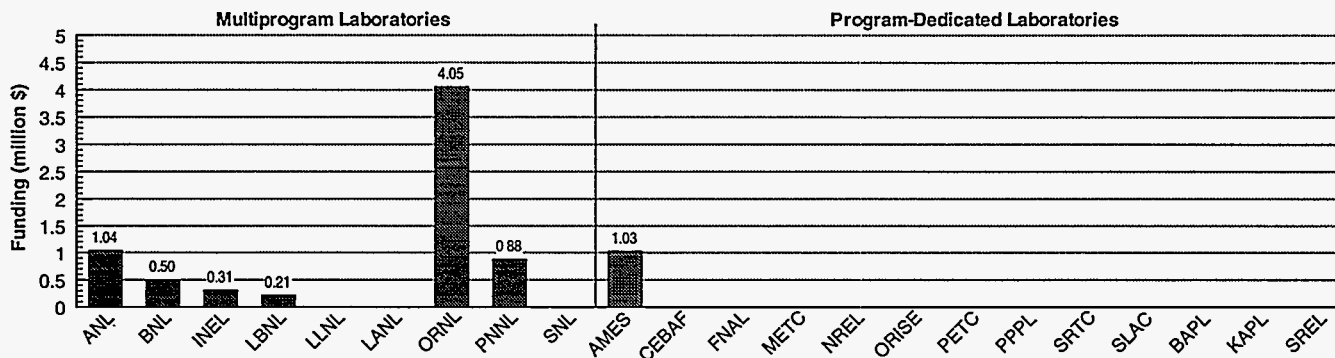


Laboratory-Academia-Industry Participation



Note: Breakdown is average over Chemical Sciences.

Fiscal Year 1995 Funding Profile



Heavy-Element Chemistry

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Chemical Sciences
 B&R Code: KC030203

Laboratory Complex

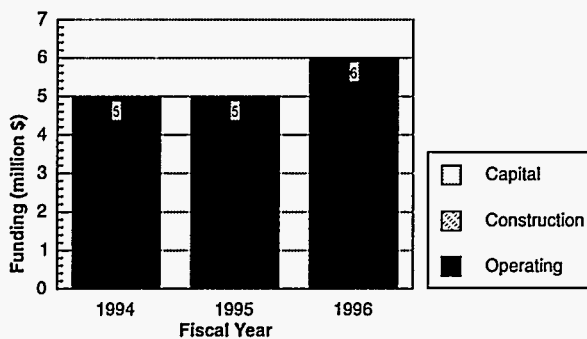
Principal Laboratories: ANL, LBNL, ORNL
 Contributing Laboratories: None
 Participating Laboratories: LANL

Mission Activity Description

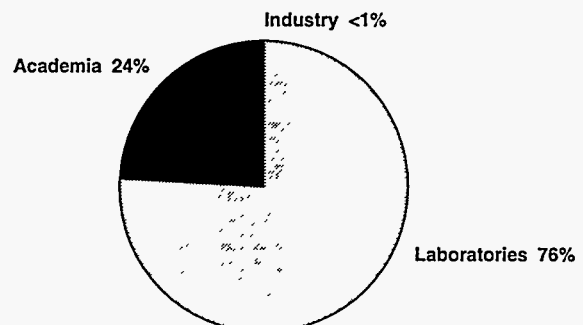
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Heavy-Element Chemistry research focuses on development of better ways to deal with radioactive materials with emphasis on understanding the chemical behavior and migration of actinide elements under environmental conditions. In particular, better ways are sought to remove heavy elements from contaminated environmental sites or radioactive wastes.

Funding History

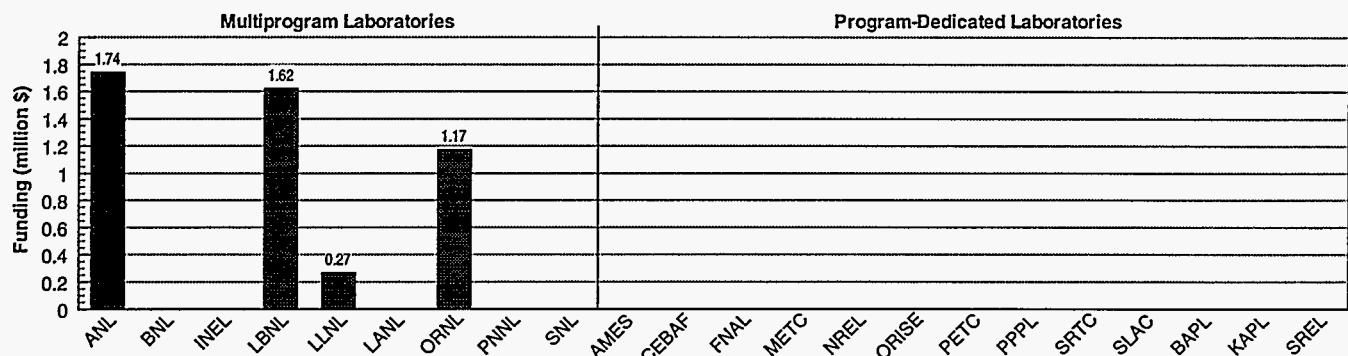


Laboratory-Academia-Industry Participation



Note: Breakdown is average over Chemical Sciences.
 FY 1995 Data

Fiscal Year 1995 Funding Profile



Chemical Engineering Sciences

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Chemical Sciences
 B&R Code: KC030204

Laboratory Complex

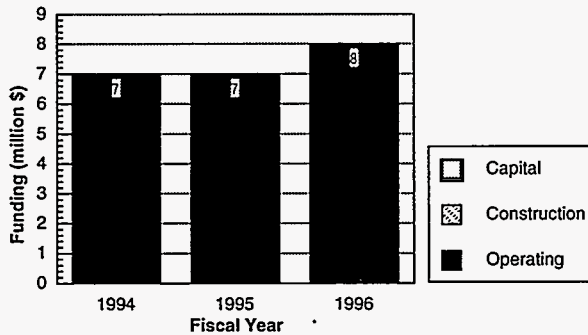
Principal Laboratories: LBNL, SNL
 Contributing Laboratories: LANL
 Participating Laboratories: Ames, ANL, BNL, NREL, ORNL

Mission Activity Description

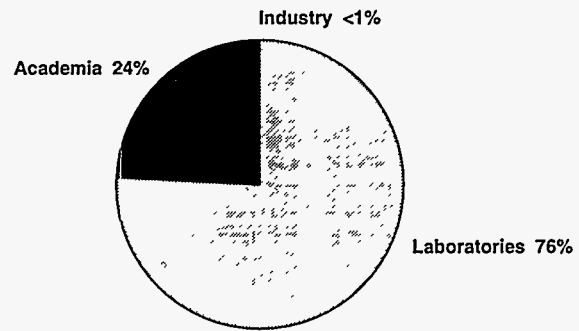
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Research in Chemical Engineering Sciences seeks to provide better and more physically realistic models for predicting the thermophysical properties and physical equilibrium of complex fluid mixtures and properties of turbulent combustion systems. The advanced battery research activity supported under this program focuses on batteries for non-automotive applications and complements the more applied program of the Office of Energy Efficiency and Renewable Energy.

Funding History

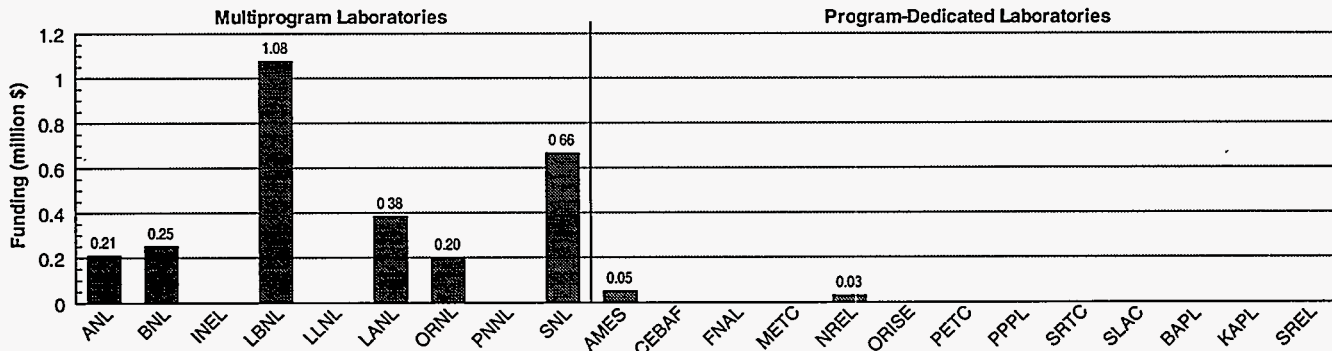


Laboratory-Academia-Industry Participation



Note: Breakdown is average over Chemical Sciences.

Fiscal Year 1995 Funding Profile



Engineering Research

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Engineering and Geosciences
 B&R Code: KC0401

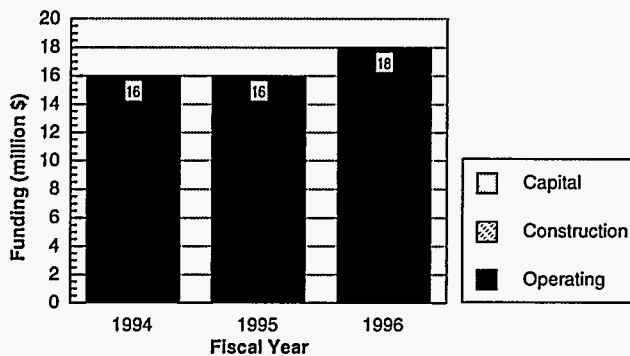
Laboratory Complex

Principal Laboratory: INEL, ORNL
 Contributing Laboratories: SNL
 Participating Laboratories: ANL, LANL, LBNL, LLNL, PNNL

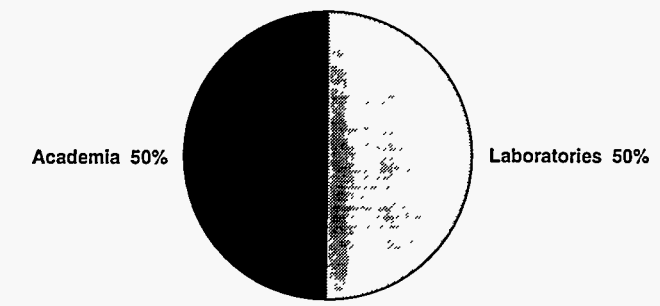
Mission Activity Description

Engineering Research serves as a conduit between basic science and applications-oriented research and development. The goal is to maintain leadership in engineering and stimulate sustainable growth. The areas of particular concern are: pollution avoidance, control, and remediation; increased energy efficiency; and assuring future energy supplies. The engineering research 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. The program advances the engineering fundamentals important to increasing energy efficiency, identifying potential new sustainable energy production and utilization processes, advancing manufacturing science, and achieving higher environmental standards. Examples include such mechanical science investigations as the formation of foams and the motion of oil and gas, behavior of suspension and slurries important to industrial processes and fossil energy transport, the hydrodynamics of pollutant dispersion in the lower atmosphere, and the flow of thin liquid films in heat transfer systems. Control systems, another area of emphasis, focus on interacting autonomous systems, reconfigurable systems which can adapt to changing tasks and environments, and the interface between biology and chemical process control aiming at improving the viability of biological processes in industrial and environmental applications. In addition, thermochemical data are obtained for the separation of aqueous-hydrocarbon mixtures for industrial processes and for environmental cleanup.

Funding History

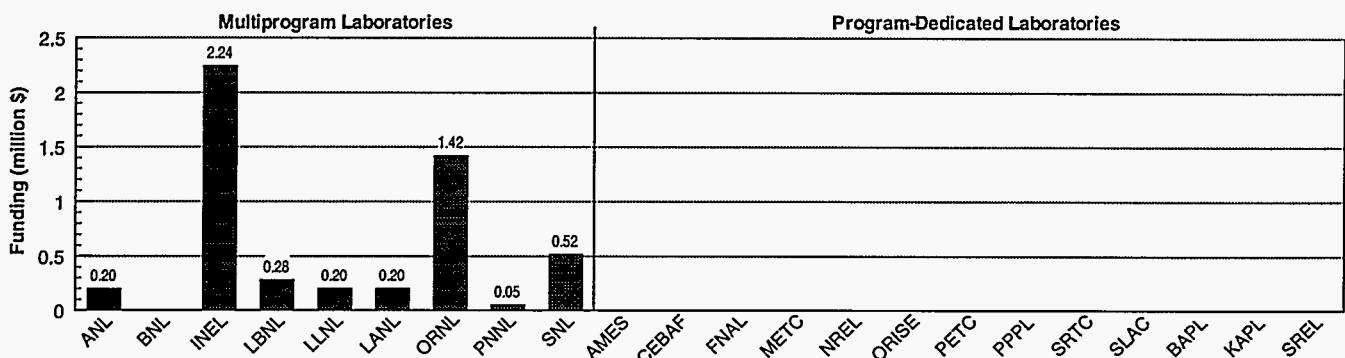


Laboratory-Academia-Industry Participation



FY 1995 Data
 Note: Breakdown is average over Engineering and Geosciences.

Fiscal Year 1995 Funding Profile



Geosciences

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Engineering and Geosciences
 B&R Code: KC0403

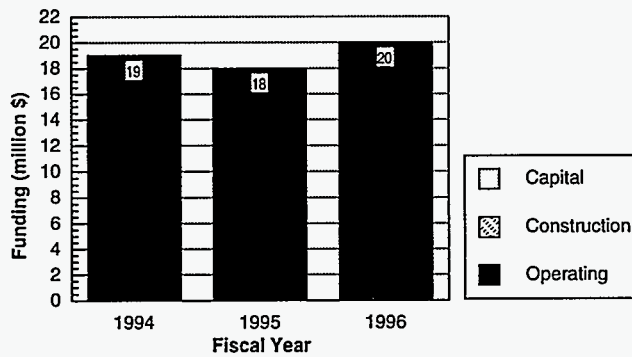
Laboratory Complex

Principal Laboratories: LANL
 Contributing Laboratories: LBNL, LLNL, ORNL, SNL
 Participating Laboratories: ANL, BNL, INEL, PNNL

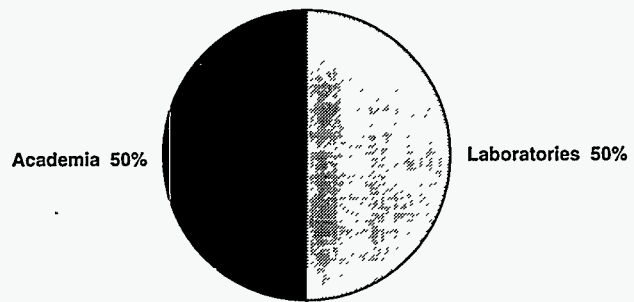
Mission Activity Description

Geosciences research provides the technical 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. Programmatic emphasis is on natural and contaminated fluids flowing in, and interacting with, porous and fractured geologic media. Underlying principles and phenomena are applicable to: improved recovery of energy resources, remediation of contaminated sites and design of waste repositories. More specifically, the study of mineral-fluid interactions develops information obtained at the atomistic scale to address larger scale problems such as waste migration. Geophysical imaging using seismic and electromagnetic geophysical methods are used to obtain information on subsurface structure, discontinuities, and physical properties. Particular emphasis is placed on fluid (geothermal, oil, gas, contaminated groundwater) bearing reservoirs. There is a continuing need for high quality fundamental physical, mechanical, thermodynamic, kinetic, and transport data on rocks, minerals and geologic fluids to model and predict the response of the geologic system to natural and anthropogenic perturbations.

Funding History



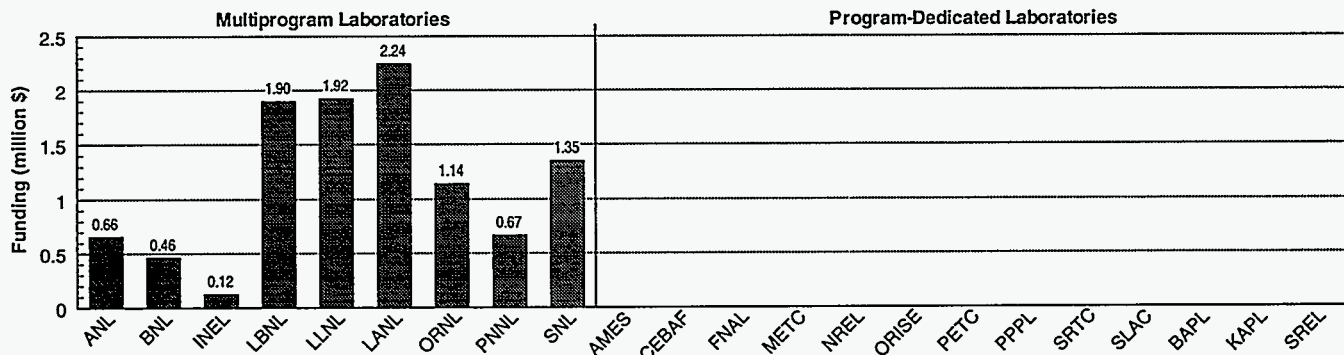
Laboratory-Academia-Industry Participation



FY 1995 Data

Note: Breakdown is average over Engineering and Geosciences.

Fiscal Year 1995 Funding Profile



Exploratory Energy Concepts

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Advanced Energy Projects
 B&R Code: KC0501

Laboratory Complex

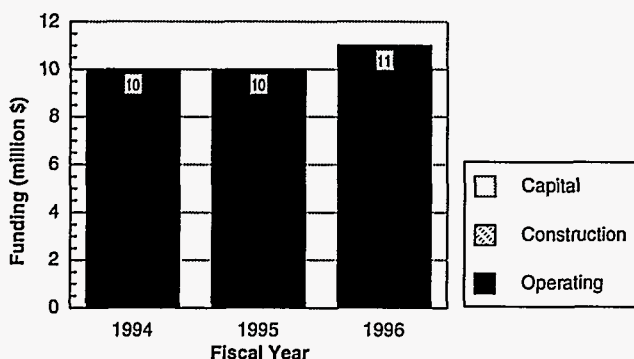
Principal Laboratories: LLNL, NREL
 Contributing Laboratories: LANL, LBNL, SNL
 Participating Laboratories: Ames, ANL

Mission Activity Description

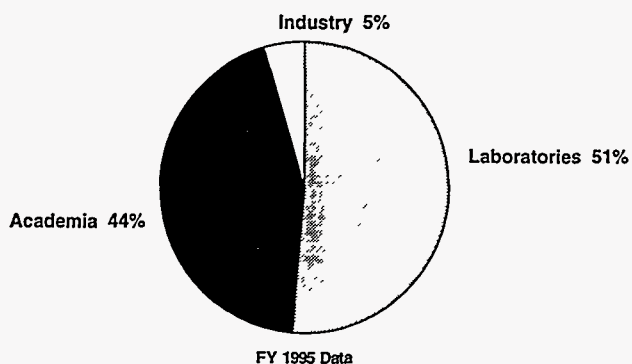
Advanced Energy Projects explores the feasibility of novel, energy-related concepts that evolve from advances in basic research. Supported projects typically are at an early stage of scientific development and, therefore, are premature for consideration by applied research or technology development programs. These projects often involve high-risk, exploratory concepts that do not readily fit into existing DOE program areas but that have the potential for high payoff in energy-related applications, sometimes spanning scientific or technical disciplines. Following support from this program, it is expected that the successful concept will be sufficiently developed and promising to attract further funding from other sources in order to realize its full potential.

The portfolio of projects is dynamic, but reflects the broad role of the Department of Energy in supporting research and development for improving the Nation's energy posture. Topical areas currently receiving support are novel materials for energy technology, renewable and biodegradable materials, exploring uses of new scientific discoveries, alternate pathways to energy efficiency, alternative energy sources, and innovative approaches to waste treatment and reduction.

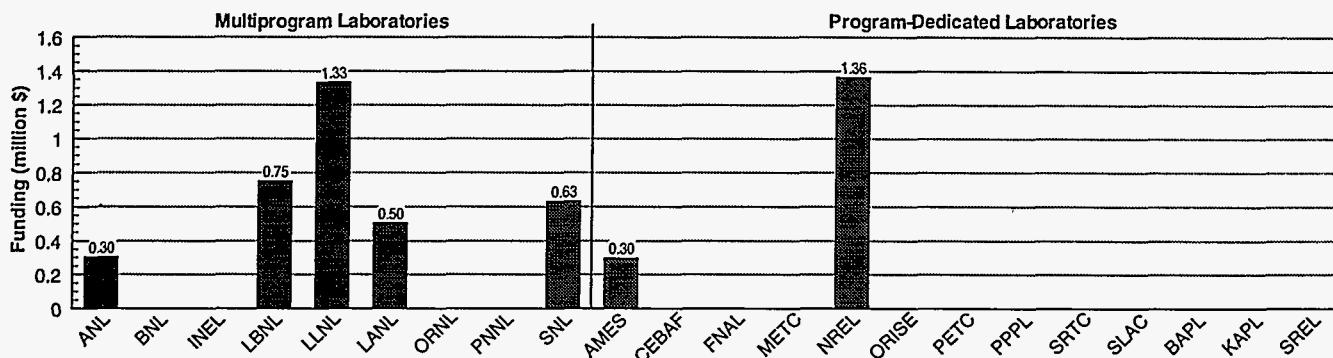
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Energy Biosciences

Department of Energy Program

Program: Energy Research
 Office: Basic Energy Sciences
 Element: Energy Biosciences
 B&R Code: KC06

Laboratory Complex

Principal Laboratories: BNL, LBNL
 Contributing Laboratories: None
 Participating Laboratories: NREL, LANL

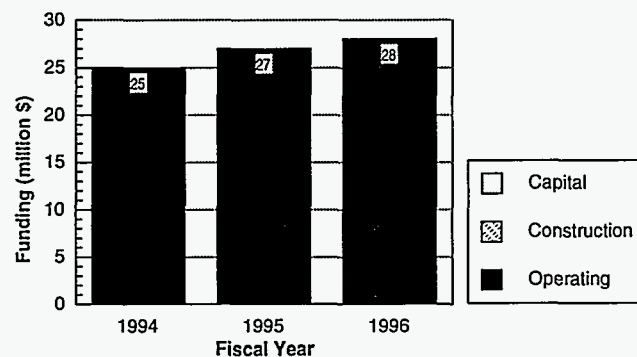
Mission Activity Description

The mission of Energy Biosciences is to support biological research which generates the basic knowledge necessary to develop and use new and existing energy resources in an environmentally sound manner. Research in the disciplines of plant science and microbiology capitalizes on the capability of plants and microbes, either alone or combined, to harvest solar energy and convert it into potential fuels, materials and chemical feedstocks. Plants and microbes (including their component parts) can also improve energy efficiency in an industrial setting and provide environmental benefits.

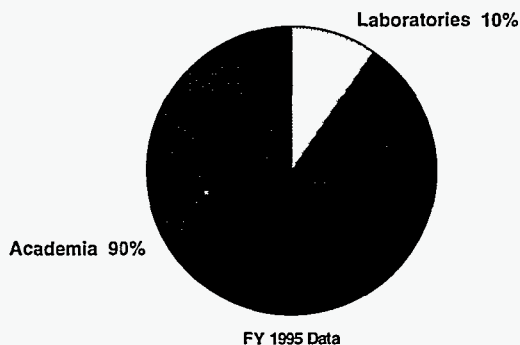
Specific examples of Energy Biosciences research areas are described below.

- (1) Research increasing our knowledge of the genetics, metabolism, physiology, development and regulation in plants to permit use of these organisms in an energy and environmental context. Of particular importance is the formation and function of plant cell walls, the major component of biomass.
- (2) Research designed to fully comprehend the process of photosynthesis is supported including the capture of solar energy, the release of molecular oxygen and the fixation of carbon dioxide into energy rich compounds.
- (3) Research to explore the mechanisms of fermentation conversions. Fermentative microorganisms are capable of readily converting large amounts of bioproducts such as cellulose and lignin into a wide variety of potential fuels and chemical feedstocks.
- (4) Research on organisms from extreme environments such as high temperature provide knowledge of the breadth of biological systems which is important in developing a framework for the adaptation of biological systems into industrial processes. Biological systems with diverse metabolic capabilities are of interest in both an environmental and energy context.

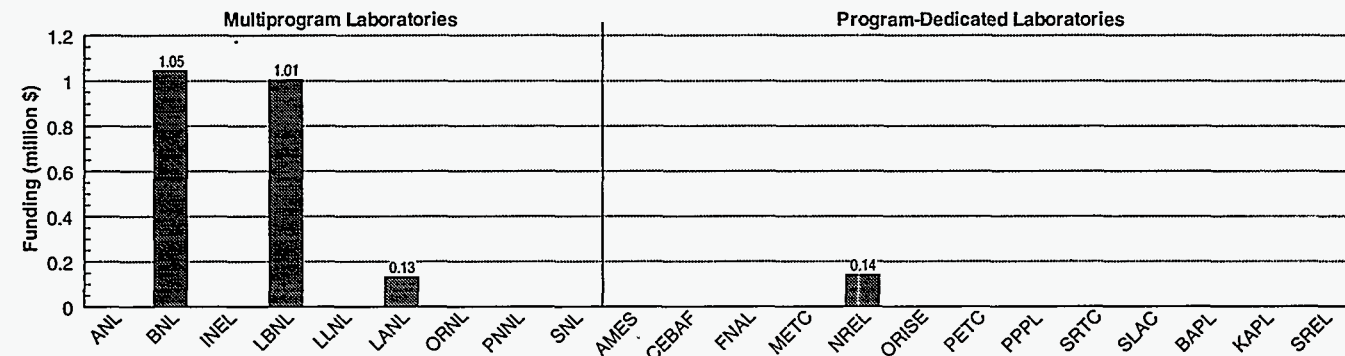
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Applied Mathematical Sciences

Department of Energy Program

Program: Energy Research
Office: Basic Energy Sciences
Element: Applied Mathematical Sciences
B&R Code: KC0701, KC0702

Laboratory Complex

Principal Laboratories: LLNL
Contributing Laboratories: ANL, LANL, ORNL
Participating Laboratories: Ames, BNL, CEBAF, FNAL, INEL, LBNL, PNNL, SNL

Mission Activity Description

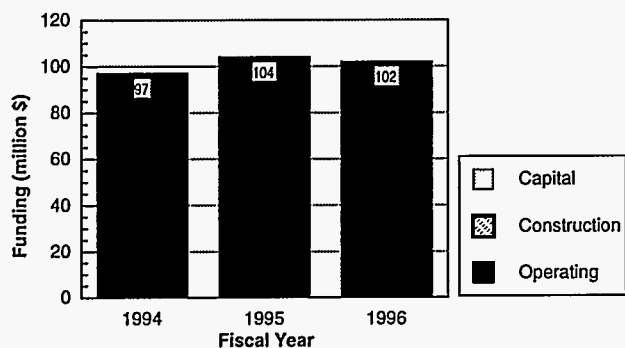
The **Applied Mathematical Sciences** research area program is a forefront, diverse applied mathematical sciences, high performance computing, communications and information infrastructure program. It spans the spectrum of activities from strategic fundamental research to technology development and demonstration. The diverse activities supported by this program are integrated to support two major strategic thrusts:

- **National Collaboratories**—Develops a set of tools and capabilities to permit scientists and engineers working at different DOE and other facilities to collaborate on solving problems as easily as if they were in the same building.
- **Advanced Computational Testing and Simulation**—Develops an integrated set of algorithms, software tools and infrastructure which enable computer simulation to be used in place of experiments when real experiments are too dangerous, expensive, inaccessible, or politically infeasible.

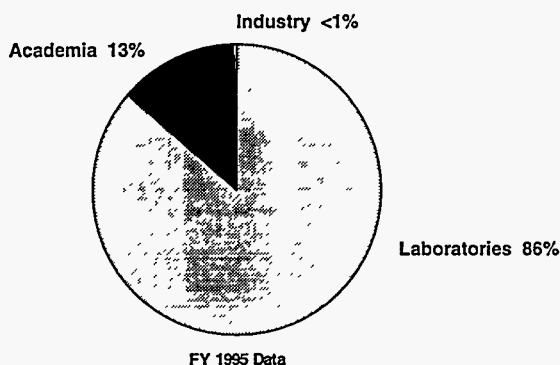
These two strategic thrusts support the underlying mathematical concepts and information technology needs of all Department of Energy (DOE) program areas (defense, energy efficiency, environmental, fossil, and so forth), and the efforts in these areas are closely coordinated with related activities supported by Defense Programs.

The program also supports and responds to the Energy Policy Act (EPACT) and to the High Performance Computing Act of 1991 (also known as the Gore Bill) and provides supercomputer access and advanced communication capabilities (through the Esnet computer network) to scientific researchers. Finally, the program also serves as an advocate within the Department to formulate and coordinate the Department's National Information Infrastructure initiative, especially to promote economically beneficial energy-related 'National Challenges' applications such as energy demand and supply management and to develop the underlying technologies to enable these applications.

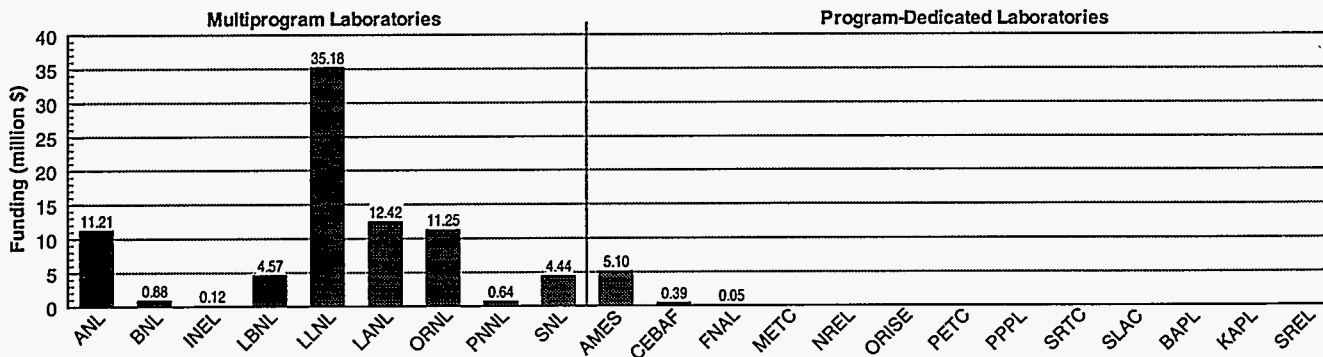
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Dosimetry Research

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: Analytical Technology
 B&R Code: KP0101

Laboratory Complex

Principal Laboratories: None
 Contributing Laboratories: None
 Participating Laboratories: LBNL, ORNL, PNNL

Mission Activity Description

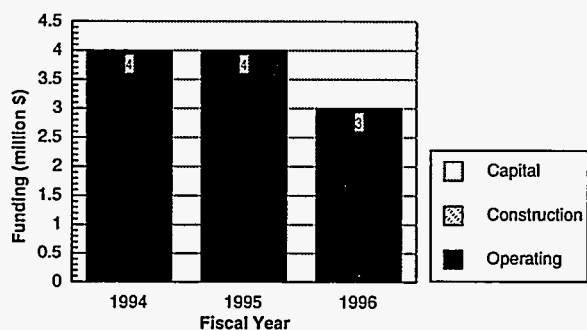
The Biological and Environmental Research (BER) program develops the knowledge needed to identify, understand, and anticipate the long-term health and environmental consequences of energy use and development through its support of peer-reviewed and competitively awarded research at national laboratories and academic institutions. The BER program uses this scientific knowledge to develop technology that can be used to mitigate or correct adverse consequences of energy use and to underpin policy and regulatory development.

Dosimetry and instrumentation research produces the advanced technology required for improved health protection practices and for an enhanced measurement capability that undergirds experimental health, biological, and environmental studies. The analytical technology subprogram involves dosimetry research and measurement science programs.

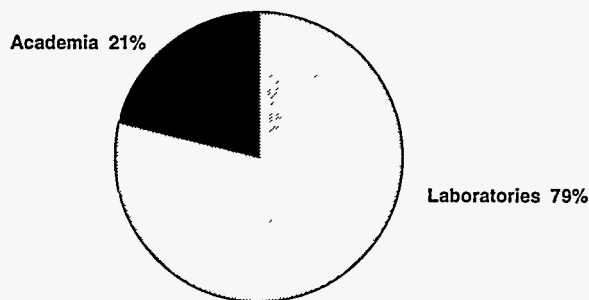
Radiation Dosimetry Research will provide an improved capability for the determination of human exposure to ionizing radiation and to environmental radon which in turn will lead to the enhanced protection of radiation workers and the general population, and a firmer basis for the evaluation of human health risk and for the development of radiation protection guidelines.

The radiation dosimetry program supports research in the field of radiation instrumentation and methodologies for measurement of radiation dose due to low linear energy transfer (LET) radiation (such as electrons, x-rays, and gamma rays) and high LET radiation (such as neutrons, alpha particles, and heavy ions). Increased emphasis is being placed on dosimetry of mixed low and high LET radiation fields since most of the radiation fields to which workers and the public may be exposed comprise such mixtures. A major concentration in the program is on the measurement of radon and its progeny in the natural indoor environment. The instruments and methodologies developed in this program will be useful for personnel and environmental monitoring.

Funding History

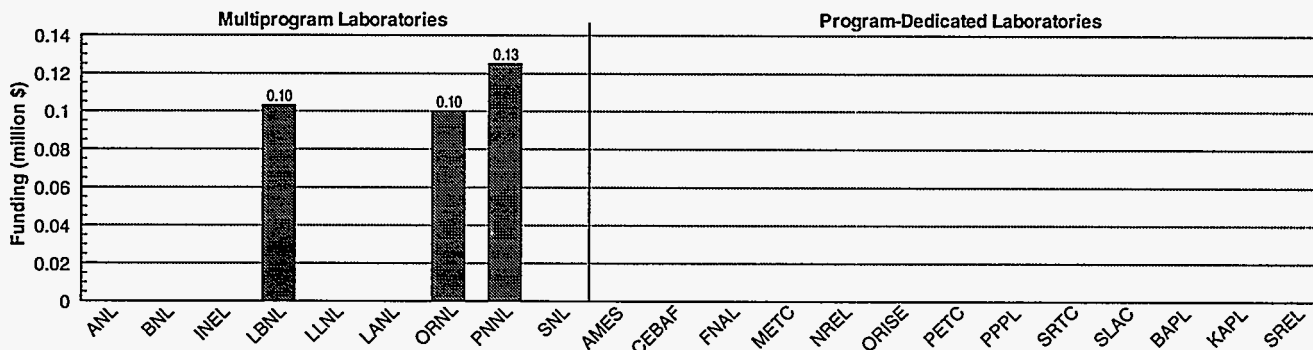


Laboratory-Academia-Industry Participation



FY 1995 Data
 Note: Includes EML in laboratory partition. The breakdown is average over Analytical Technology.

Fiscal Year 1995 Funding Profile



Measurement Science

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Analytical Technology
B&R Code: KP0102

Laboratory Complex

Principal Laboratories: None
Contributing Laboratories: ORNL
Participating Laboratories: Ames, ANL, BNL, INEL, LBNL, LLNL, PNNL

Mission Activity Description

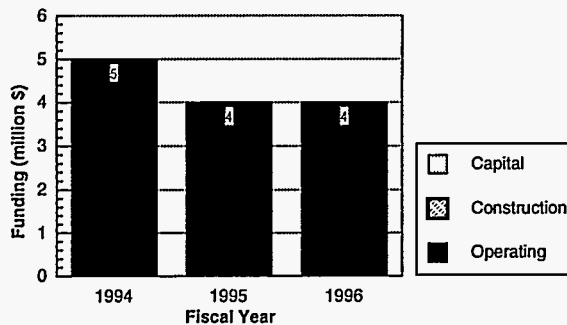
The Biological and Environmental Research (BER) program develops the knowledge needed to identify, understand, and anticipate the long-term health and environmental consequences of energy use and development through its support of peer-reviewed and competitively awarded research at national laboratories and academic institutions. The BER program uses this scientific knowledge to develop technology that can be used to mitigate or correct adverse consequences of energy use and to underpin policy and regulatory development.

Dosimetry and instrumentation research produce the advanced technology required for improved health protection practices and for an enhanced measurement capability that undergirds experimental health, biological, and environmental studies.

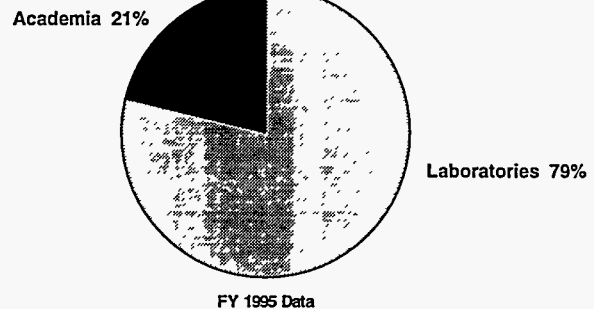
Measurement Science will provide new technology for chemical characterization of biological systems with high spatial and temporal resolution in support of the health effects program, and for study of ocean and subsurface environments, including mixed hazardous wastes, in support of the environmental sciences program. In addition to providing an advanced instrumentation capability for the health, biological, and environmental research programs, these new measurement technologies are transferred to the private sector for commercial application with the resultant benefit to the U.S. economy of increased international competitiveness.

The measurement science program supports research in analytical chemistry directed at meeting the needs for new measurement technology for the missions of the Office of Health and Environmental Research in the environmental and life sciences. The program has funded development of optical spectroscopy (notably resonance ionization spectroscopy), sensors for remote monitoring, and imaging technologies. This program was recompeted in fiscal year 1995 to emphasize oceanographic measurement technologies for the Global Climate Program, characterization of contaminated subsurface environments, cellular and subcellular imaging, and sensors.

Funding History

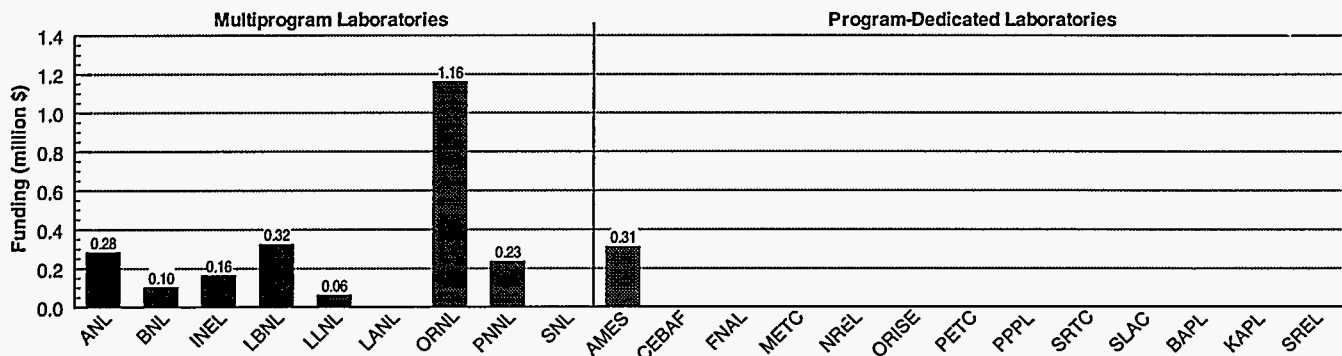


Laboratory-Academia-Industry Participation



Note: Includes EML in laboratory partition. The breakdown is average over Analytical Technology.

Fiscal Year 1995 Funding Profile



Atmospheric Science

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Environmental Research
B&R Code: KP0201

Laboratory Complex

Principal Laboratories: PNNL, BNL
Contributing Laboratories: ANL
Participating Laboratories: LANL, LBNL, LLNL, ORNL

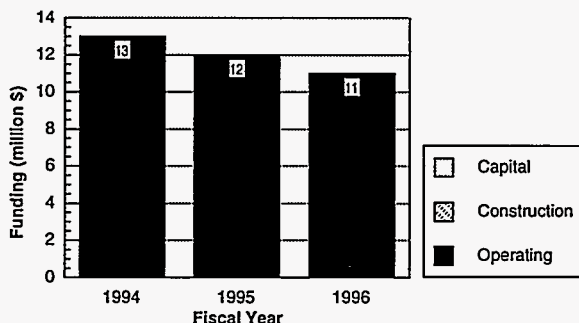
Mission Activity Description

Emissions and disturbances from energy sources have impacts at scales from local to worldwide. Environmental research is intended to improve the predictive understanding of the potential environmental consequences of energy production and use, and to identify and quantify energy-related environmental tradeoffs or constraints that may limit or impede sustainable development. This program addresses the transport of emissions and their behavior through the atmosphere, oceans, solid earth, and ecosystems at differing spatial scales and time sequences. The program is tied to the goal of sustainable development through increased understanding of the fate of pollutants and the ability to remediate or restore existing or future sites.

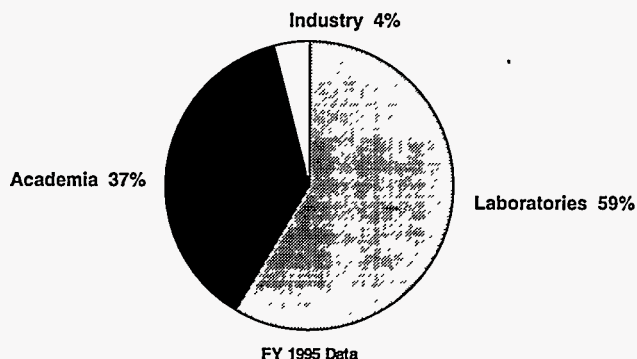
The Atmospheric Science program has two components. The first is atmospheric chemistry and addresses the processes that control tropospheric and stratospheric ozone and aerosol formation. Fine aerosols are a continuing scientific issue and current controversy in global environmental change and human health. Reduced emphasis will be placed with the second component, which explores transport and diffusion over complex terrain with the goal of enhancing the emergency preparedness and response systems at critical DOE sites.

Atmospheric chemistry research focuses on tropospheric and stratospheric ozone and fine aerosols to strengthen regional, continental, and global models.

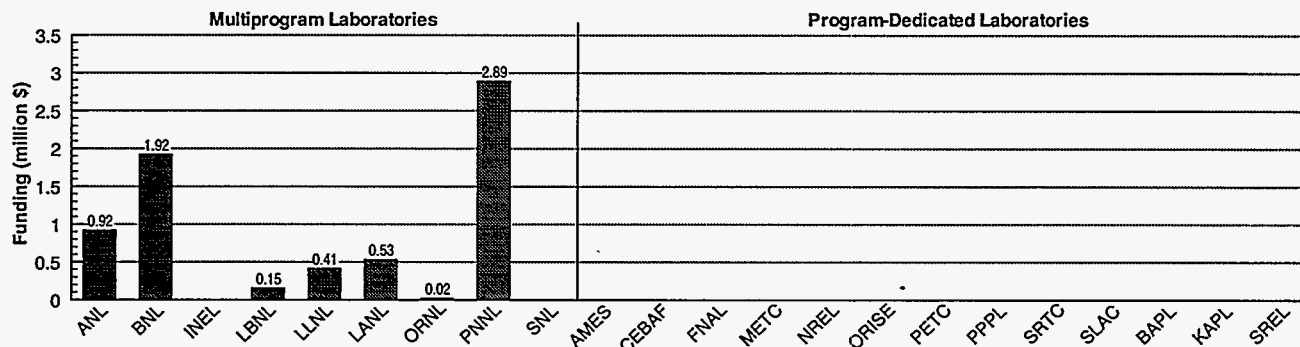
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Marine Transport

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Environmental Research
B&R Code: KP0201

Laboratory Complex

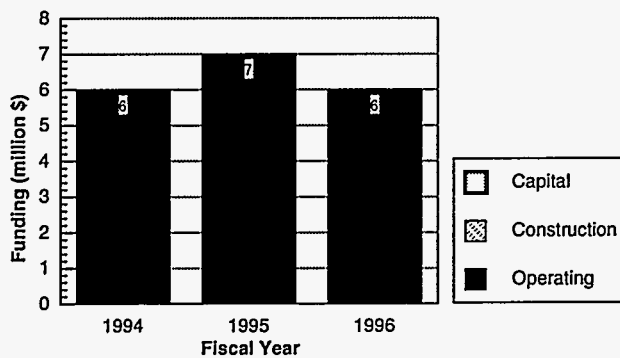
Principal Laboratories: BNL
Contributing Laboratories: None
Participating Laboratories: ORISE

Mission Activity Description

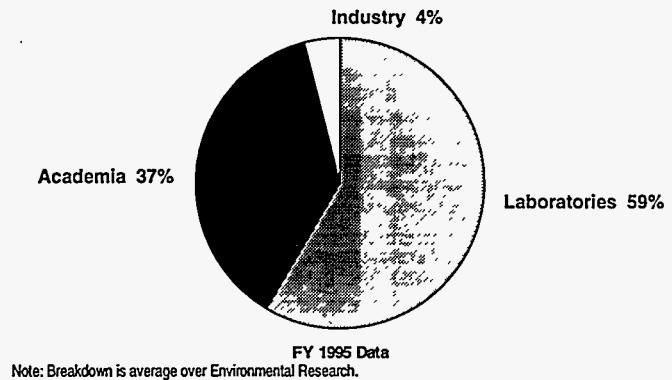
Emissions and disturbances from energy sources have impacts at scales from local to worldwide. Environmental research is intended to improve the predictive understanding of the potential environmental consequences of energy production and use, and to identify and quantify energy-related environmental tradeoffs or constraints that may limit or impede sustainable development. This program addresses the transport of emissions and their behavior through the atmosphere, oceans, solid earth, and ecosystems at differing spatial scales and time sequences. The program is tied to the goal of sustainable development through increased understanding of the fate of pollutants and the ability to remediate or restore existing or future sites.

Marine Transport research investigates the exchange of energy-related and natural materials between the continental shelf and the open ocean. Close collaboration with other programs conducting open-ocean and near-shore research helps in understanding the dynamics of the ocean margins and its influence on both land and open-ocean systems, particularly from the viewpoint of energy discharges and their assimilation into the ocean. With as much as half of the productivity of the ocean located along the ocean margins, this program is also providing important information on carbon flux and may hold the key to a significant part of the missing component of the worldwide carbon budget.

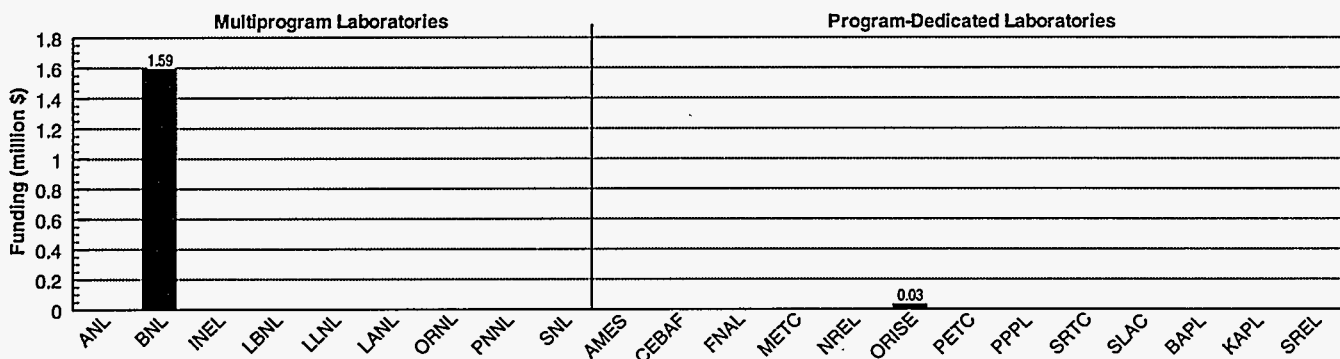
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Terrestrial Transport

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: Environmental Research
 B&R Code: KP0203

Laboratory Complex

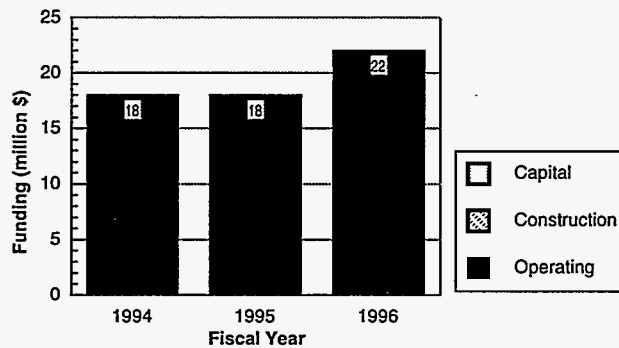
Principal Laboratories: PNNL
 Contributing Laboratories: ORNL
 Participating Laboratories: ANL, BNL, INEL, LANL, LBNL, ORISE

Mission Activity Description

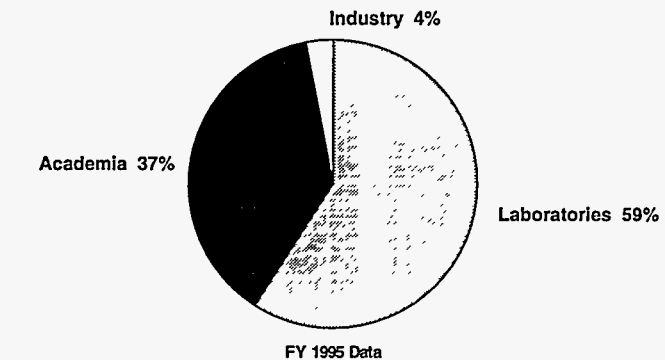
Emissions and disturbances from energy sources have impacts at scales from local to worldwide. Environmental research is intended to improve the predictive understanding of the potential environmental consequences of energy production and use, and to identify and quantify energy-related environmental tradeoffs or constraints that may limit or impede sustainable development. This program addresses the transport of emissions and their behavior through the atmosphere, oceans, solid earth, and ecosystems at differing spatial scales and time sequences. The program is tied to the goal of sustainable development through increased understanding of the fate of pollutants and the ability to remediate or restore existing or future sites.

The Terrestrial Transport program includes subsurface science research on sediments and groundwater systems, on microbial communities in deep sediments and aquifers, and on the mechanisms that control the mobility of organic-radionuclide complexes. The research addresses the fundamental physical, chemical, and microbiological mechanisms that control reactivity, stability, and transport of chemical mixtures, as well as hydrogeological and geochemical factors that control the presence, distribution, and origins of microbial communities in deep geological systems. Research on microbial origins includes studies of what may be ancient microbial communities that have evolved in situ and communities that have been transported at various times to the deep subsurface. DOE deep microbiological research has gained international recognition, and new microorganisms have been discovered at great depths. Research is also conducted on bacterial transport processes, leading to bioremediation and to the assessment of the risks associated with release of genetically engineered microorganisms (GEMs).

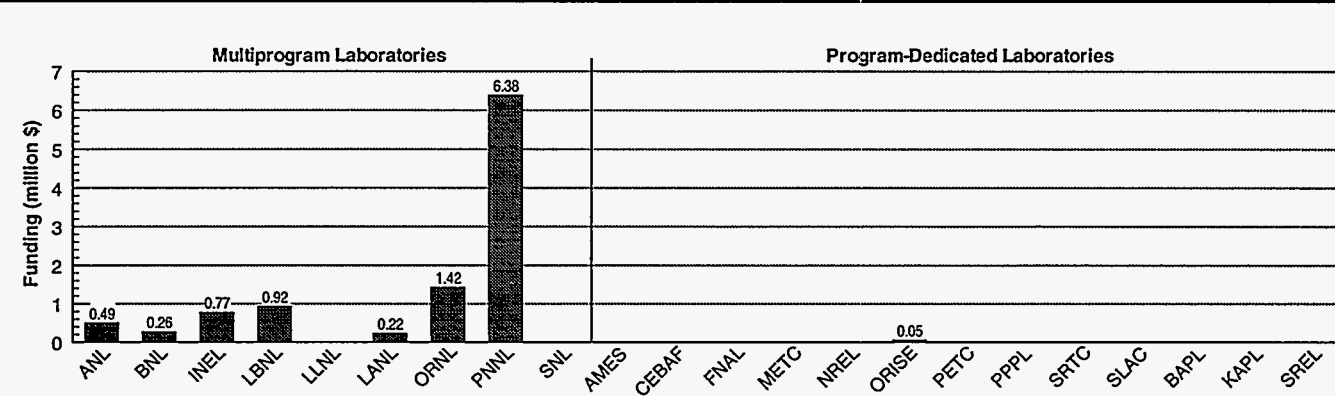
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Ecosystem Functioning and Response

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: Environmental Research
 B&R Code: KP0204

Laboratory Complex

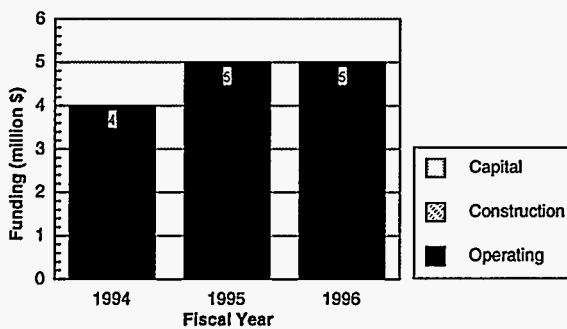
Principal Laboratories: ORNL
 Contributing Laboratories: ANL
 Participating Laboratories: BNL, INEL, LANL, LLNL, PNNL

Mission Activity Description

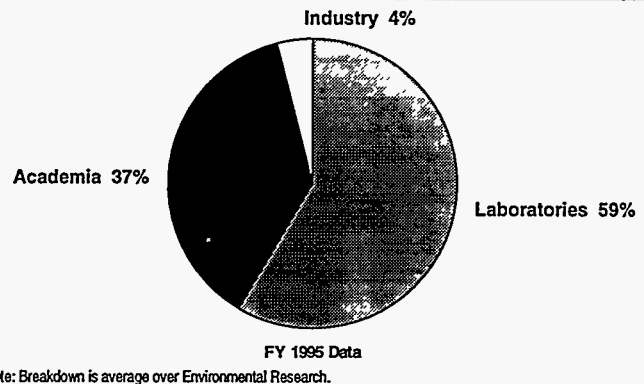
Emissions and disturbances from energy sources have impacts at scales from local to worldwide. Environmental research is intended to improve the predictive understanding of the potential environmental consequences of energy production and use, and to identify and quantify energy-related environmental tradeoffs or constraints that may limit or impede sustainable development. This program addresses the transport of emissions and their behavior through the atmosphere, oceans, solid earth, and ecosystems at differing spatial scales and time sequences. The program is tied to the goal of sustainable development through increased understanding of the fate of pollutants and the ability to remediate or restore existing or future sites.

Research on Ecosystem Functioning and Response is focused in the Program for Ecosystem Research (PER) to provide knowledge of biological adjustment and impact caused by global change and to develop an understanding of the mechanisms controlling them. This knowledge will assist DOE in resolving its environmental problems and provide a biological basis for making ecological risk and injury assessments. The theoretical, modeling, and field/laboratory experiments will be integrated in multidisciplinary research projects that are coordinated through the DOE Environmental Research Parks.

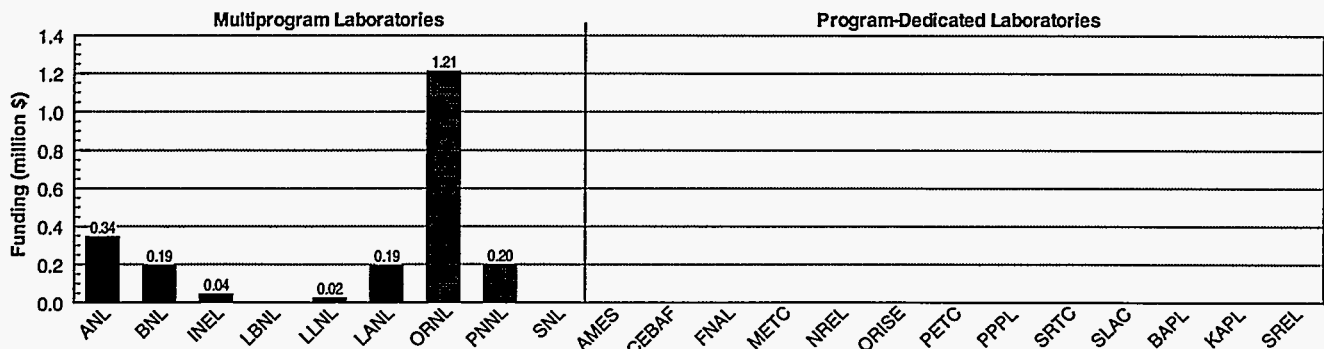
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Biological Research

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: Health Effects
 B&R Code: KP0302

Laboratory Complex

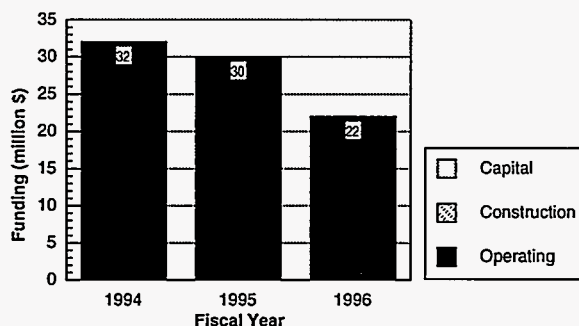
Principal Laboratory: None
 Contributing Laboratories: ANL, LBNL, ORNL, PNNL
 Participating Laboratories: BNL, LANL, LLNL, ORISE

Mission Activity Description

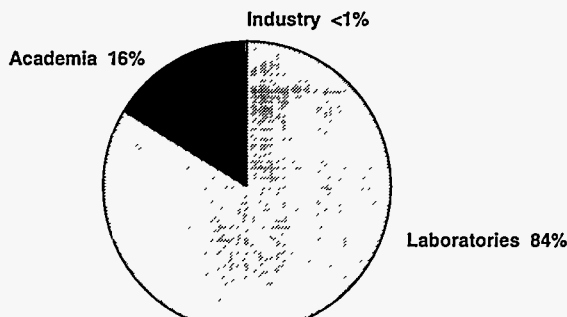
The Health Effects Research Program develops biological information and advanced technologies relevant to understanding and mitigating the potential health effects of energy development, energy use, and waste cleanup. The thrust of this program is to improve our abilities to estimate the type and magnitude of human health risk that result from low-level exposures to energy-related agents. Such agents include radiation and chemicals both at home (for example, radon) and at work (for example, waste site cleanup). Factors affecting susceptibility to exposure or disease vary from one individual to another and may, therefore, significantly alter the health impacts of low-level exposures to some individuals more than to others. The Health Effects program conducts research to develop new molecular-based tools for health surveillance, biological dosimetry, and individual susceptibility determination. An emphasis is placed on research that utilizes the unique resources and tools developed in the Department's human genome and cellular and molecular biology programs.

The Biological Research program provides scientific information to understand and mitigate the potential health effects from energy activities and cleanup operations. Emphasis is placed on the risks to human health from exposures to low-levels of radiation and chemicals both at home (for example, radon) and at work (for example, waste site cleanup). This includes research on the toxicity and the mechanisms of that toxicity of chemicals and radiations found in DOE cleanup sites in support of the DOE's waste cleanup efforts and to exploit advances made in the genome program by facilitating their introduction and use in both basic and applied research with a continued emphasis on improved estimation of risk to individuals.

Funding History

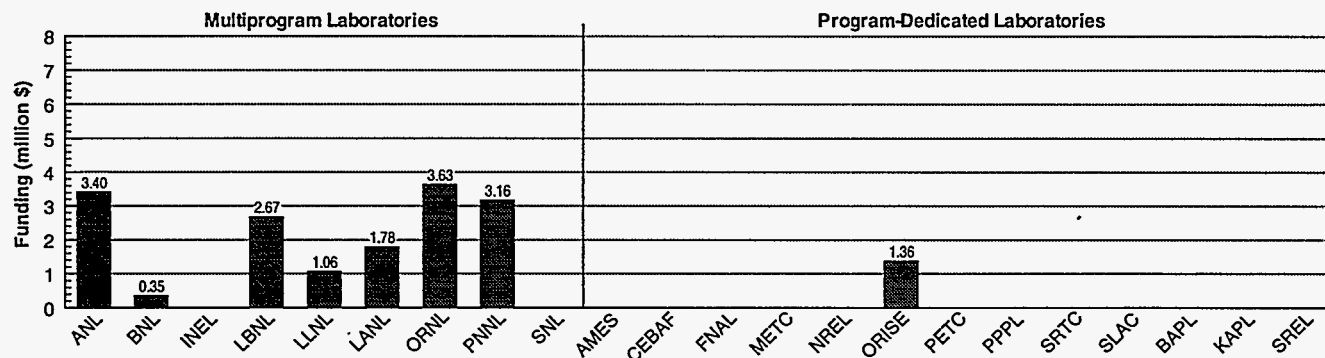


Laboratory-Academia-Industry Participation



FY 1995 Data
 Note: Includes ITRI and LREH in laboratory partition. The breakdown is average over Health Effects.

Fiscal Year 1995 Funding Profile



Radiological and Chemical Physics

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: Health Effects
 B&R Code: KP0303

Laboratory Complex

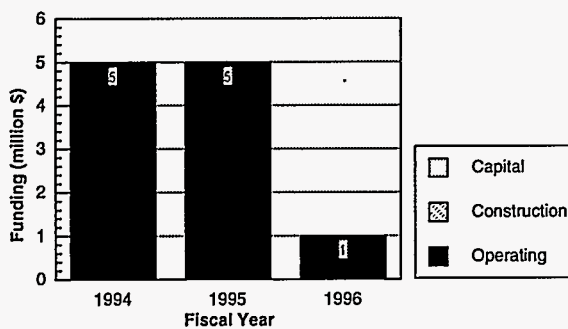
Principal Laboratories: ORNL, PNNL
 Contributing Laboratories: ANL, LBNL
 Participating Laboratories: ORISE

Mission Activity Description

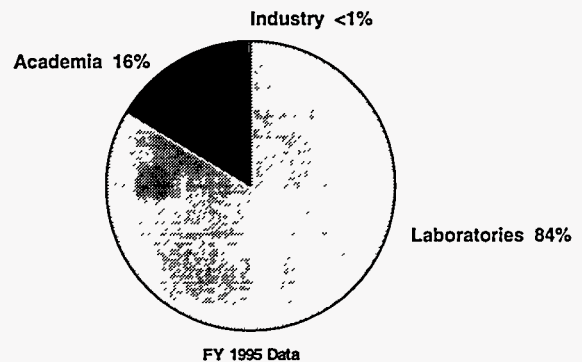
The Health Effects Research Program develops biological information and advanced technologies relevant to understanding and mitigating the potential health effects of energy development, energy use, and waste cleanup. The thrust of this program is to improve our abilities to estimate the type and magnitude of human health risk that result from low-level exposures to energy-related agents. Such agents include radiation and chemicals both at home (for example, radon) and at work (for example, waste site cleanup). Factors affecting susceptibility to exposure or disease vary from one individual to another and may, therefore, significantly alter the health impacts of low-level exposures to some individuals more than to others. The Health Effects program conducts research to develop new molecular-based tools for health surveillance, biological dosimetry, and individual susceptibility determination. An emphasis is placed on research that utilizes the unique resources and tools developed in the Department's human genome and cellular and molecular biology programs.

The Radiological and Chemical Physics subprogram has provided basic information on the initial events that occur following the interactions of radiation with biological molecules. This subprogram is being phased out in fiscal year 1996.

Funding History

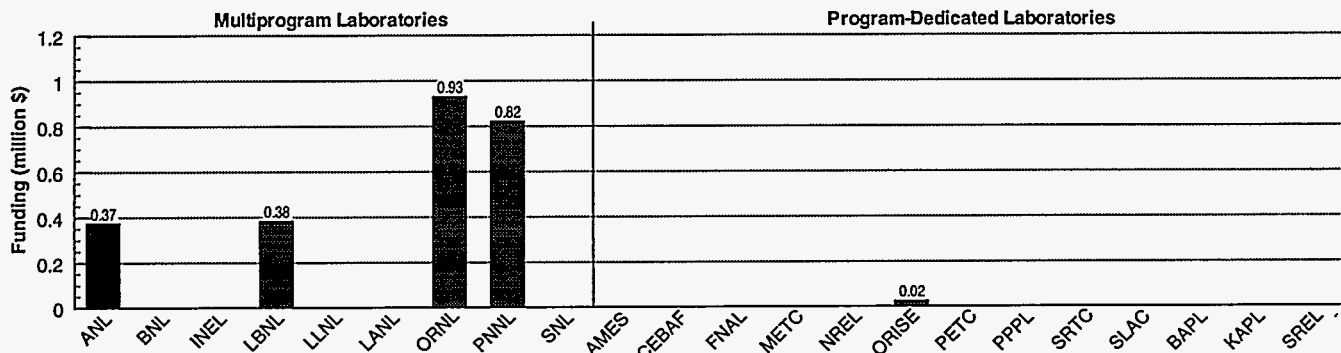


Laboratory-Academia-Industry Participation



Note: Breakdown is average over Health Effects.

Fiscal Year 1995 Funding Profile



Structural Biology

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: General Life Sciences
 B&R Code: KP0401

Laboratory Complex

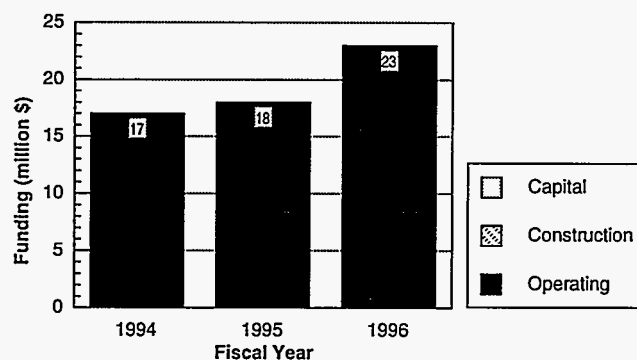
Principal Laboratories: BNL
 Contributing Laboratories: ANL, LBNL
 Participating Laboratories: LANL, LLNL, ORNL, PNNL, SLAC

Mission Activity Description

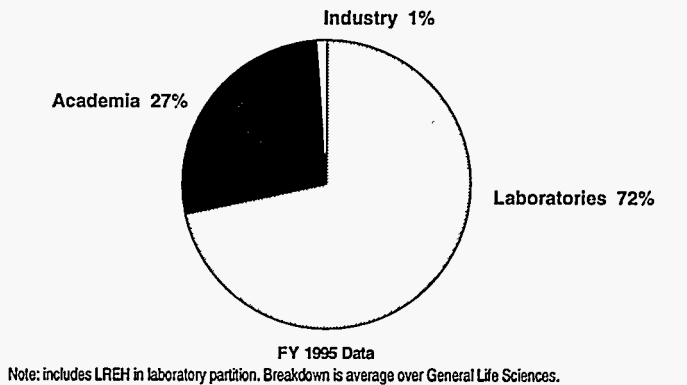
The General Life Sciences Research Program develops basic scientific information to understand fundamental life processes and molecules. Research provides critical information regarding the molecular nature of the human genome and genomes of other organisms, and it explores how the basic chemical structures of important biological molecules relates to their function in living cells. The program develops biological information and advanced technologies for use in health effects research studies; and it develops and utilizes unique DOE resources and facilities to provide information to underpin new technologies to address Departmental and national goals in the areas of biotechnology and waste cleanup. The information and technologies developed in this research advance the biotechnology missions of the Department including: improved industrial processes, increased agricultural yields, energy production from biomass, environmental remediation, and improved human health.

Structural Biology research develops and supports DOE national user facilities such as the Advanced Light Source at LBNL, the new multipurpose beamline at SSRL, and the new Structural Biology Center at the Synchrotron Radiation Source at ANL. These facilities enable scientists to determine the molecular structure of important biological molecules, such as enzymes, antibodies, or other proteins. This knowledge will provide insight into the structure-function relationships, such as enzymes modified to enhance bioremediation (for example, to detoxify a hazardous waste). Computational structural biology combines computer science, structural biology, and genome research to predict the functions of biological molecules.

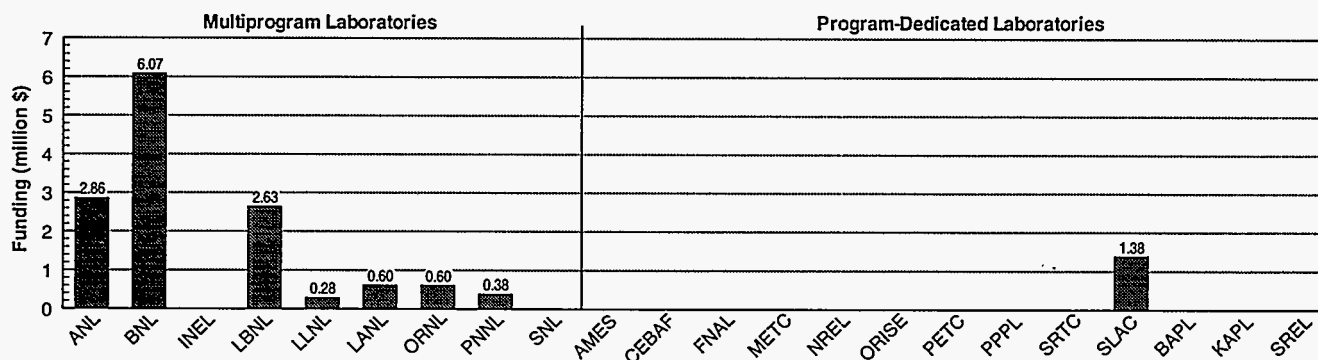
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Molecular and Cellular Biology

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: General Life Sciences
B&R Code: KP0402, KP0403

Laboratory Complex

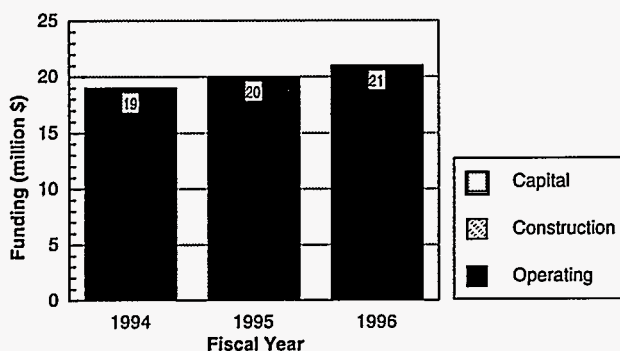
Principal Laboratories: ORNL
Contributing Laboratories: BNL, LANL, LBNL, LLNL
Participating Laboratories: ANL, ORISE, PNNL

Mission Activity Description

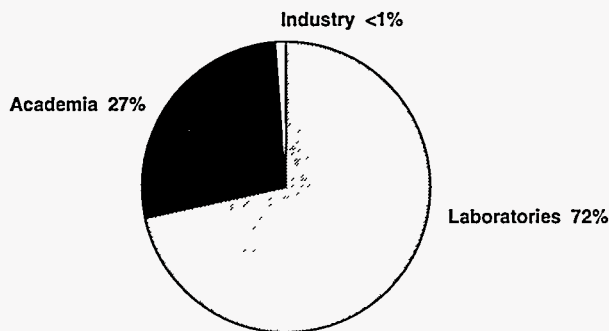
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Basic Molecular and Cellular Biology research identifies and characterizes genes that repair damaged DNA and control cell proliferation to determine individual responsiveness to energy-related materials and susceptibility to adverse health effects, including cancer. Research includes the use of isolated human and animal DNA repair genes and enzymes to assess variability in repair among human populations.

Funding History

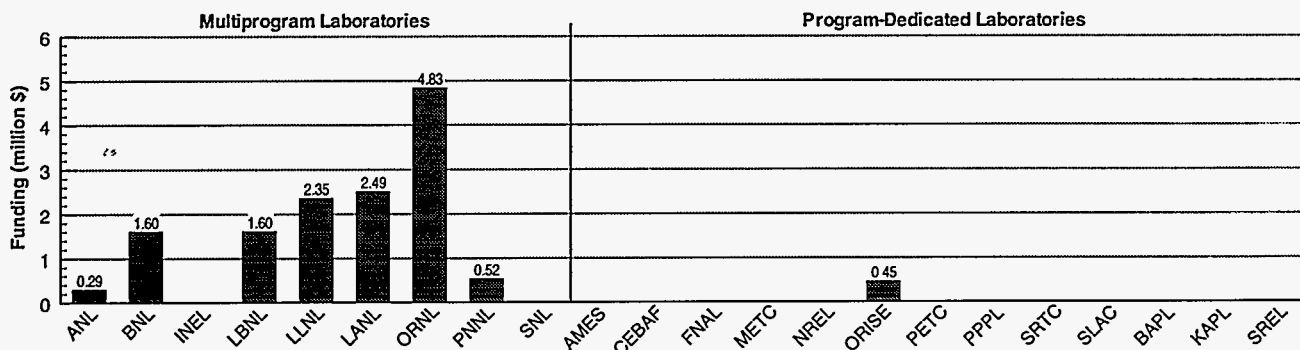


Laboratory-Academia-Industry Participation



FY 1995 Data
 Note: Includes LREH in laboratory partition. Breakdown is average over General Life Sciences.

Fiscal Year 1995 Funding Profile



Genome Research

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: General Life Sciences
 B&R Code: KP0404

Laboratory Complex

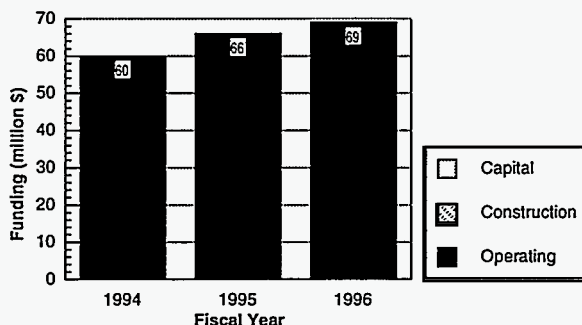
Principal Laboratories: LANL, LBNL, LLNL
 Contributing Laboratories: None
 Participating Laboratories: Ames, ANL, BNL, ORISE, ORNL, PNNL

Mission Activity Description

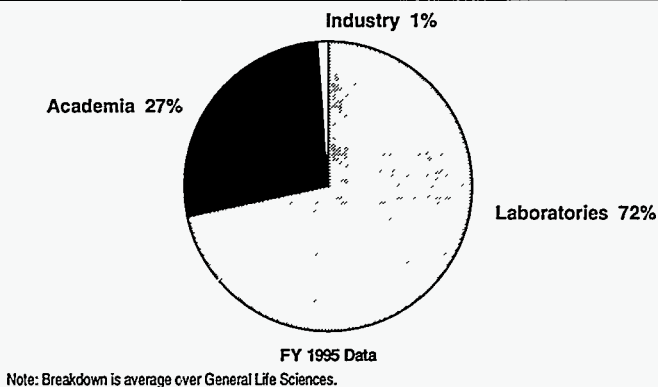
The General Life Sciences Research Program develops basic scientific information to understand fundamental life processes and molecules. Research provides critical information regarding the molecular nature of the human genome and genomes of other organisms, and it explores how the basic chemical structures of important biological molecules relates to their function in living cells. The program develops biological information and advanced technologies for use in health effects research studies; and it develops and utilizes unique DOE resources and facilities to provide information to underpin new technologies to address Departmental and national goals in the areas of biotechnology and waste cleanup. The information and technologies developed in this research advance the biotechnology missions of the Department including: improved industrial processes, increased agricultural yields, energy production from biomass, environmental remediation, and improved human health.

Genome Research develops and applies new technologies and resources to map and determine the sequence of bases that make up the DNA found in a typical human cell and supports studies in ethical, legal, and social implications (ELSI), especially issues of privacy, commercialization, and education. Microbial genome research characterizes the DNA and proteins in microbes with biotechnology applications in energy production, environmental bioremediation, and industry.

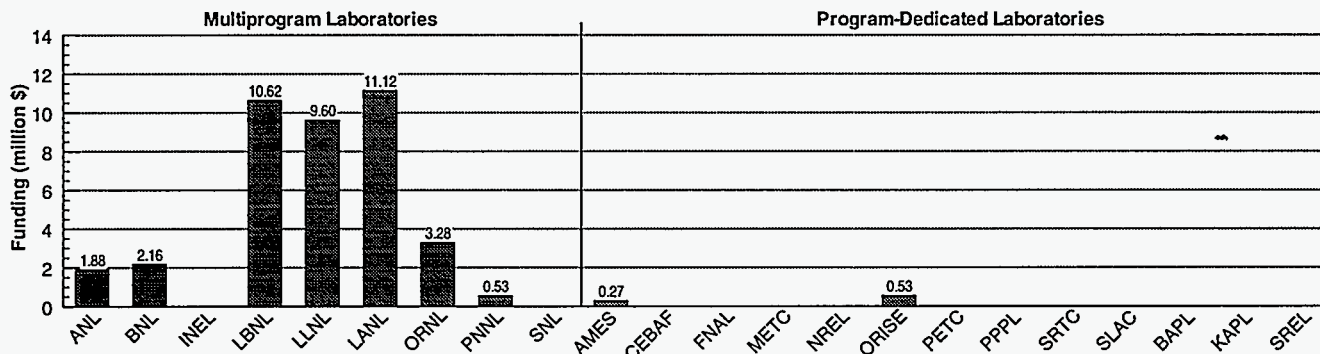
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Global Change Research

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Carbon Dioxide Research
B&R Code: KP0501, KP0506, KP0508, KP0509, KP0510

Laboratory Complex

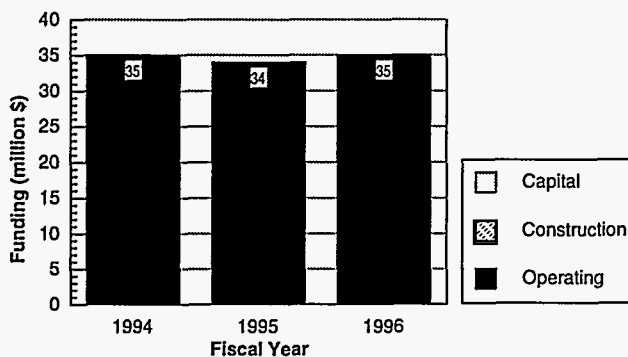
Principal Laboratories: LLNL
Contributing Laboratories: ORISE, ORNL
Participating Laboratories: ANL, BNL, LANL, LBNL, PNNL

Mission Activity Description

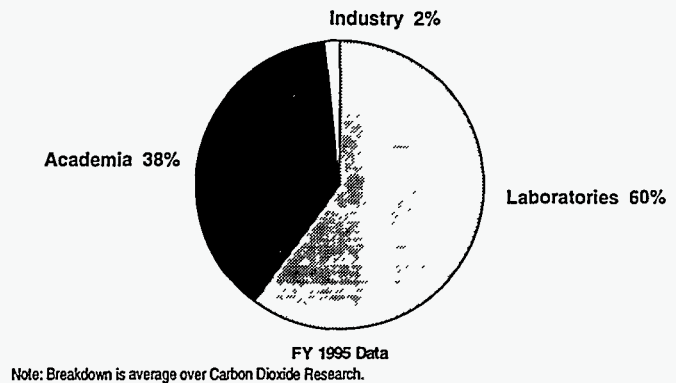
Carbon Dioxide Research is focused on understanding the basic chemical, physical, and biological processes of the Earth's atmosphere, land, and oceans and how these processes may be affected by energy production and use, primarily the emission of carbon dioxide from fossil fuel combustion. The research is designed to provide the data that will enable an objective assessment of the potential for, and consequences of, global warming.

The link between carbon dioxide and global warming has important impacts on energy policy, economic development, and international affairs. Global Change Research emphasis is placed on experimental studies of the cloud-climate feedback, on innovative hardware-software applications to advanced climate models, and on the impacts and mitigation of global environmental change. In the core program, the carbon cycle research will address fluxes of carbon dioxide (CO₂) between atmosphere, biosphere, and land and ocean surfaces, and of cycling of carbon within the terrestrial biosphere and the oceans. This understanding is required for predicting atmospheric CO₂ change due to fossil fuel use and deforestation and for estimating sinks for excess CO₂ generated by fossil fuel. Products from this research include mechanisms for sequestering carbon as a means for stabilizing atmospheric CO₂. By mitigating atmospheric greenhouse gas increases and associated climate change, this research provides vital information for assessments of future sustainable development and environmental protection. The core program also develops and tests models that predict the global and regional climate change induced by increasing atmospheric concentrations of CO₂ and other greenhouse gases. This includes modeling climate change, with emphasis on the coupled climate system of the atmosphere, ocean, and cryosphere. A key element is support of the Program for Climate Model and Diagnosis and Intercomparison which engages virtually every climate modeling group in the world.

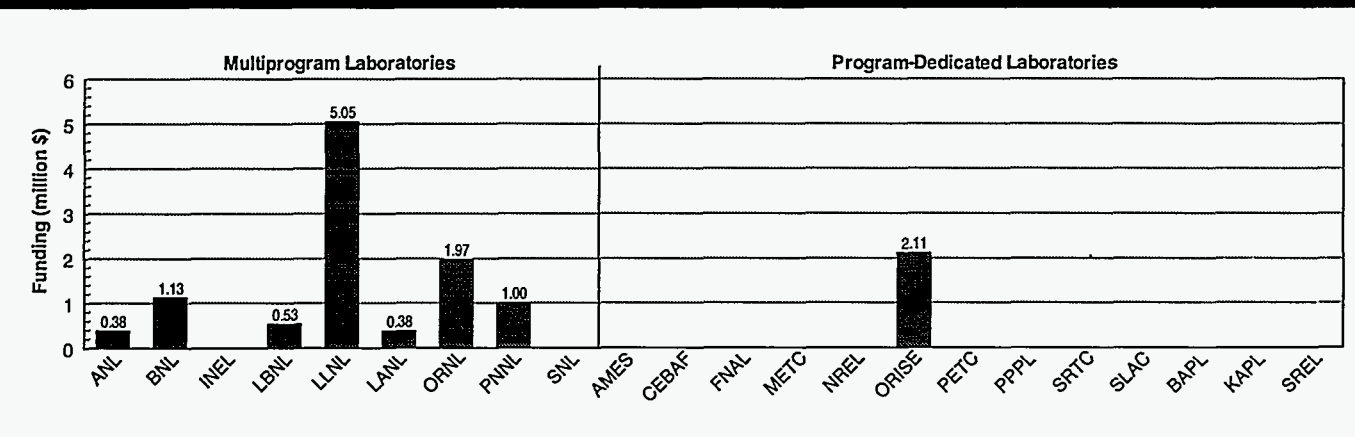
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Carbon Dioxide Information Analysis

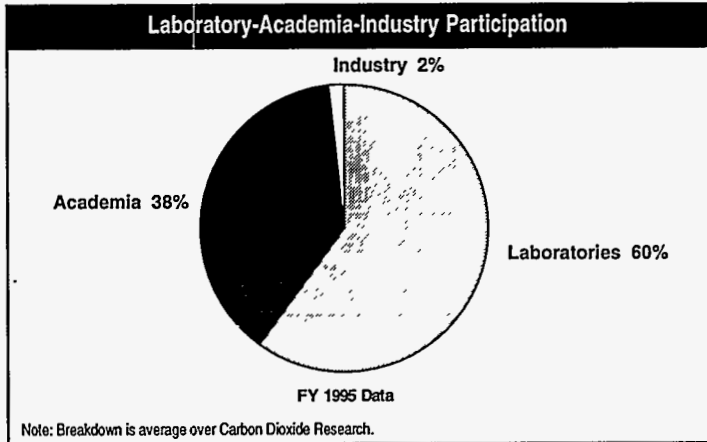
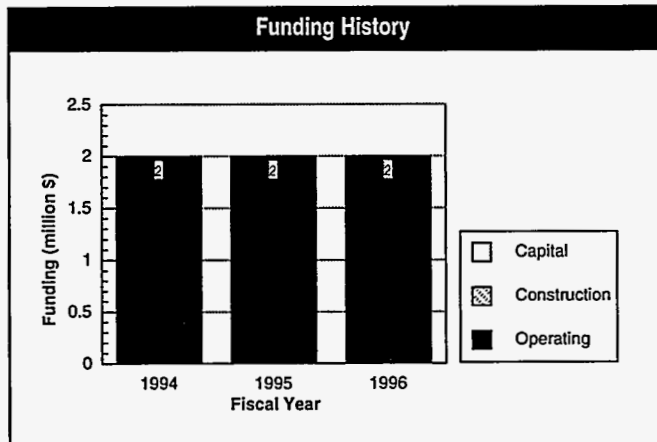
Department of Energy Program	
Program:	Energy Research
Office:	Health and Environmental Research
Element:	Carbon Dioxide Research
B&R Code:	KP0502

Laboratory Complex
Principal Laboratories: ORNL
Contributing Laboratories: ORISE
Participating Laboratories: None

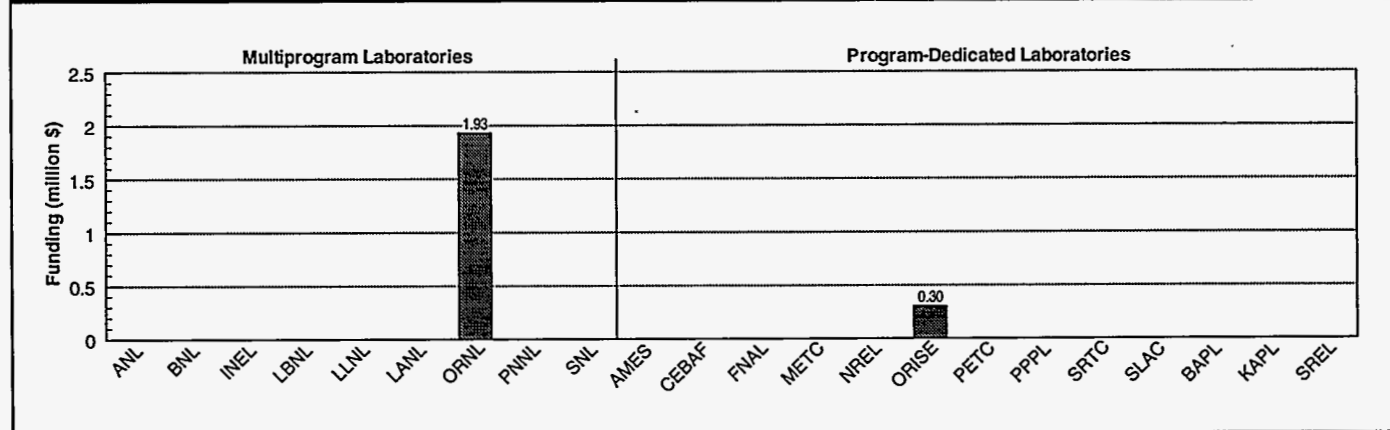
Mission Activity Description

Carbon Dioxide Research is focused on understanding the basic chemical, physical, and biological processes of the Earth's atmosphere, land, and oceans and how these processes may be affected by energy production and use, primarily the emission of carbon dioxide from fossil fuel combustion. The research is designed to provide the data that will enable an objective assessment of the potential for, and consequences of, global warming.

The Carbon Dioxide Information Analysis activity operates the ORNL Carbon Dioxide Information Analysis Center, including its operation as a World Data Center under the United Nations auspices. The Center conducts quality audits on global and regional data sets and makes the data sets available to global change researchers and policy makers.



Fiscal Year 1995 Funding Profile



Advanced Mathematics and Model Physics

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Carbon Dioxide Research
B&R Code: KP0503

Laboratory Complex

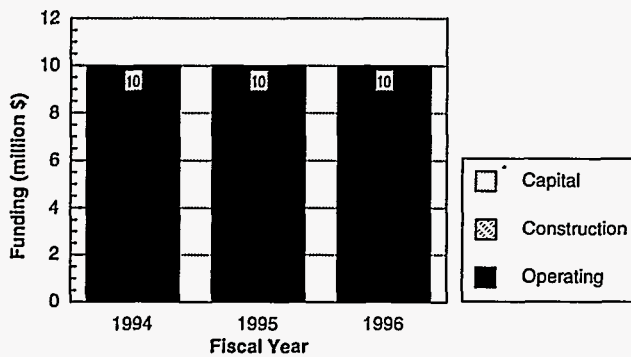
Principal Laboratories: LANL
Contributing Laboratories: LLNL, ORNL
Participating Laboratories: ANL, BNL, PNNL, SNL

Mission Activity Description

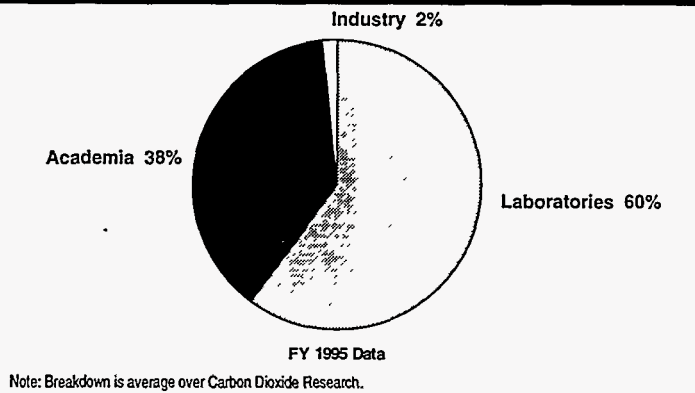
Research is focused on understanding the basic chemical, physical, and biological processes of the Earth's atmosphere, land, and oceans and how these processes may be affected by energy production and use, primarily the emission of carbon dioxide from fossil fuel combustion. The research is designed to provide the data that will enable an objective assessment of the potential for, and consequences of, global warming.

The Computer Hardware, Advanced Mathematics and Model Physics (CHAMMP) activity accelerates and improves prediction of the response of global and regional climates to the increasing atmospheric concentration of CO₂ and other greenhouse gases. Developing advanced climate models requires a better theoretical foundation for long-term climate prediction and computers capable of increasing throughput by a factor of a least 10,000 over 1990 era models, as well as mathematical formulations and software that use parallel processing and improved algorithms.

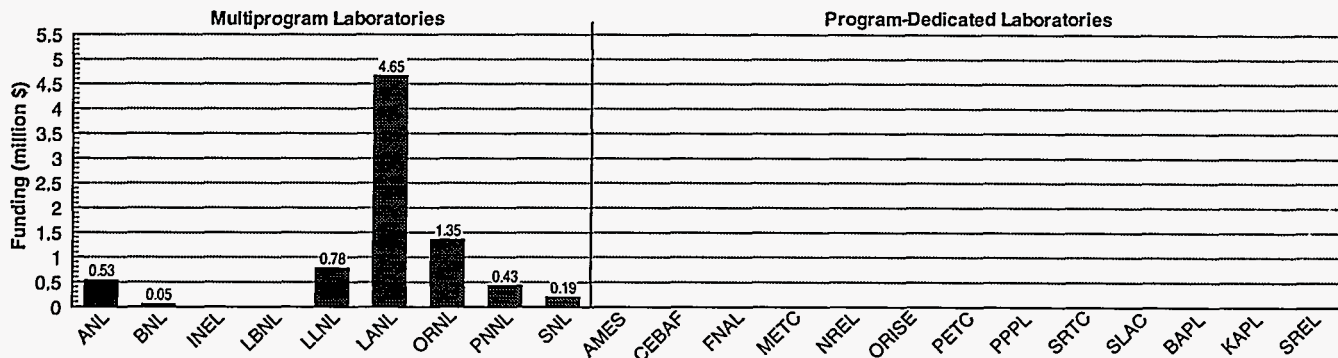
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Atmospheric Radiation Measurement

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: Carbon Dioxide Research
 B&R Code: KP0504

Laboratory Complex

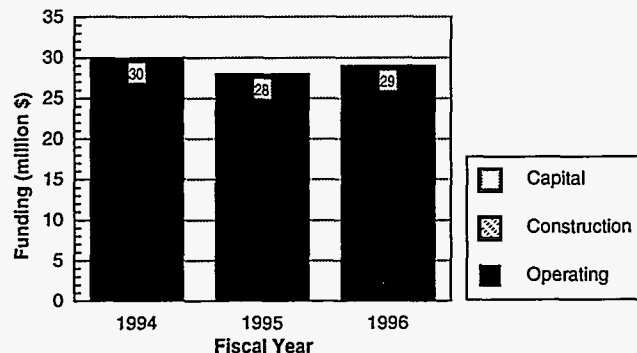
Principal Laboratories: PNNL
 Contributing Laboratories: None
 Participating Laboratories: ANL, BNL, LANL, LLNL, SNL

Mission Activity Description

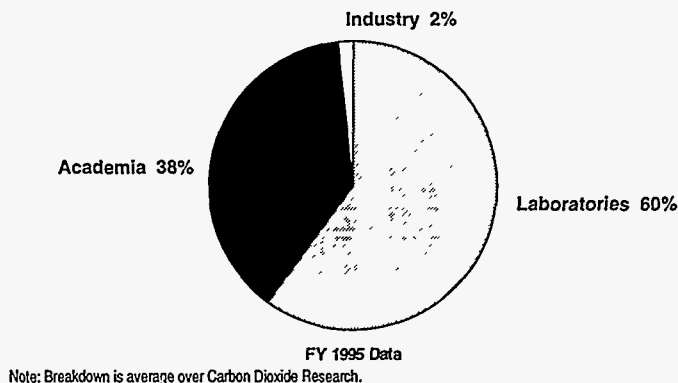
Research is focused on understanding the basic chemical, physical, and biological processes of the Earth's atmosphere, land, and oceans and how these processes may be affected by energy production and use, primarily the emission of carbon dioxide from fossil fuel combustion. The research is designed to provide the data that will enable an objective assessment of the potential for, and consequences of, global warming.

The Atmospheric Radiation Measurement activity determines the radiation balance from the surface of the Earth to the top of the atmosphere and the atmospheric characteristics responsible for this balance, improves the parameterization of the formation and evolution of clouds in climate models, creates an experimental testbed for testing process models used in general circulation models and supports satellite ground-truth measurements. The research involves a network of ground-based remote sensing instruments as well as campaign studies using aircraft and tethered platforms. The research focuses on quantitative links between greenhouse gases and climate change and examines climate feedbacks and energy fluxes in the coupled land-atmosphere-ocean system. The research also examines atmospheric cycling and transformation of radiatively and chemically important trace species.

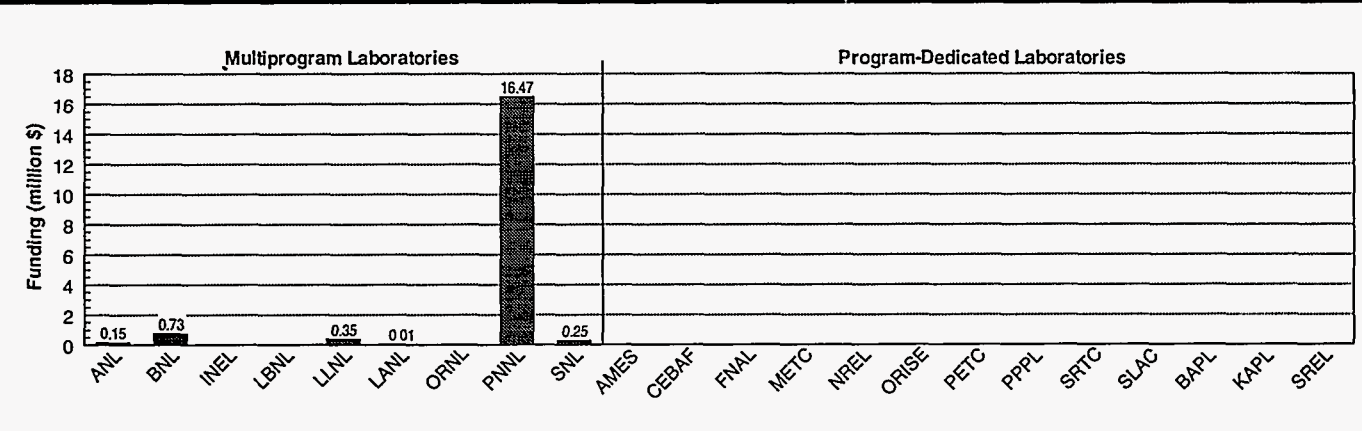
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Oceans Research

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Carbon Dioxide Research
B&R Code: KP0505

Laboratory Complex

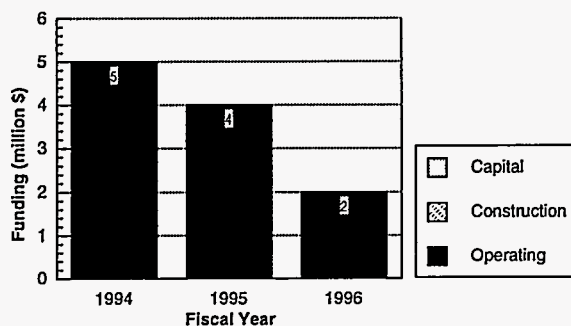
Principal Laboratories: BNL, PNNL
Contributing Laboratories: None
Participating Laboratories: ORNL

Mission Activity Description

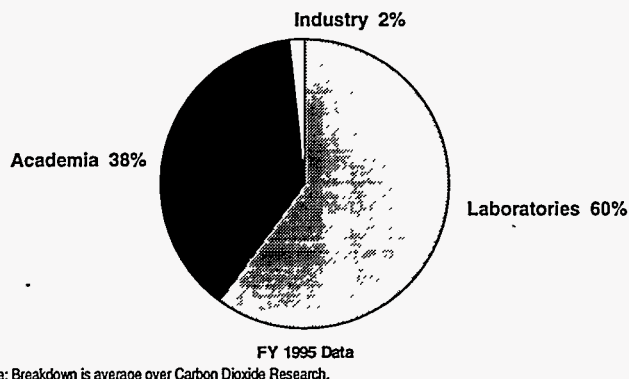
Research is focused on understanding the basic chemical, physical, and biological processes of the Earth's atmosphere, land, and oceans and how these processes may be affected by energy production and use, primarily the emission of carbon dioxide from fossil fuel combustion. The research is designed to provide the data that will enable an objective assessment of the potential for, and consequences of, global warming.

The Oceans Research activity conducts a global survey of CO₂ in the ocean to improve ocean circulation models used for climate research. The research involves integrated laboratory, observational, and modeling studies to understand mixing, transport processes, and carbon cycling in the ocean and the exchange of heat and carbon between the ocean and the atmosphere. The activity is focused on central questions concerning the rates of carbon and heat transport in the ocean, and changes in the oceanic CO₂ reservoir.

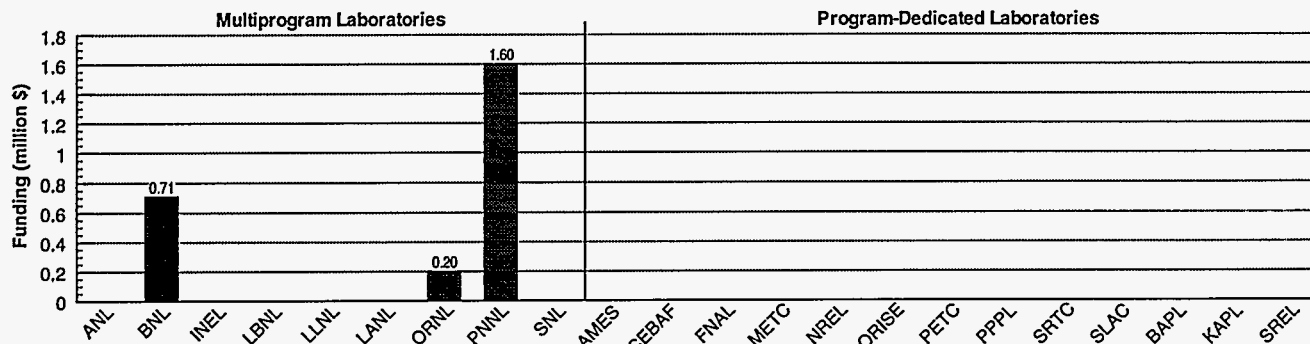
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Radioisotope Development

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: Medical Applications
 B&R Code: KP060101

Laboratory Complex

Principal Laboratories: BNL, FNAL
 Contributing Laboratories: ORNL
 Participating Laboratories: None

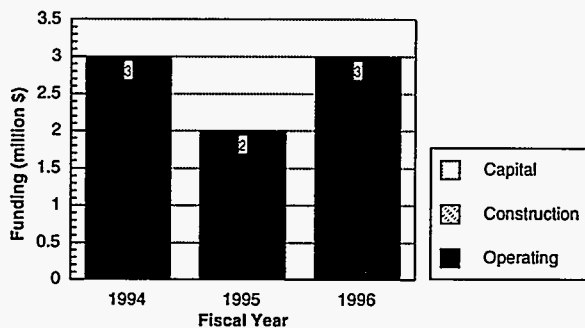
Mission Activity Description

The Medical Applications research program, mandated initially by the Atomic Energy Act of 1946 to promote use of radioactive materials and radiation for medical applications, has provided the scientific and technological foundation for the establishment of nuclear medicine as a major clinical specialty. Research in radioisotope production, radiopharmaceutical chemistry, radioisotope imaging instrumentation together with investigation of a broad range of diagnostic and therapeutic applications demonstrated and validated advanced diagnostic and therapeutic capability and also led to the establishment of a vital radionuclide production, radiopharmaceutical development, and radionuclide instrumentation industry. Technology developed under this program provides a noninvasive capability for detection and localization of small lesions, for quantitative measurement of dynamic organ function, and for selective radioisotope and radiation therapy of cancer and has achieved a reduction in medical costs through, for example, avoidance of unnecessary surgery.

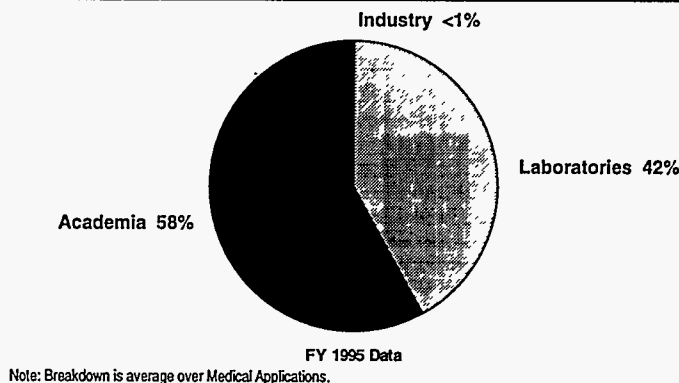
The central goal and objectives of the Medical Applications program are to enhance the Department's nuclear and other energy technologies by introducing recent advances in molecular and structural biology, develop integrated powerful tools of radiotracer agents, positron emission tomography, single photon emission computed tomography, advanced image processing and informatics for noninvasive diagnosis of patients' problems, and the tools of molecular therapies, including genetically engineered monoclonal antibodies and boron carrier compounds.

Radioisotope Development includes efforts in optimizing target design, radioisotope processing, purification, and generator development for medically useful radioisotopes. Research emphasis is on new radioisotope generators for onsite storage, separation, and availability of radioisotopes for medical use in a clinical setting.

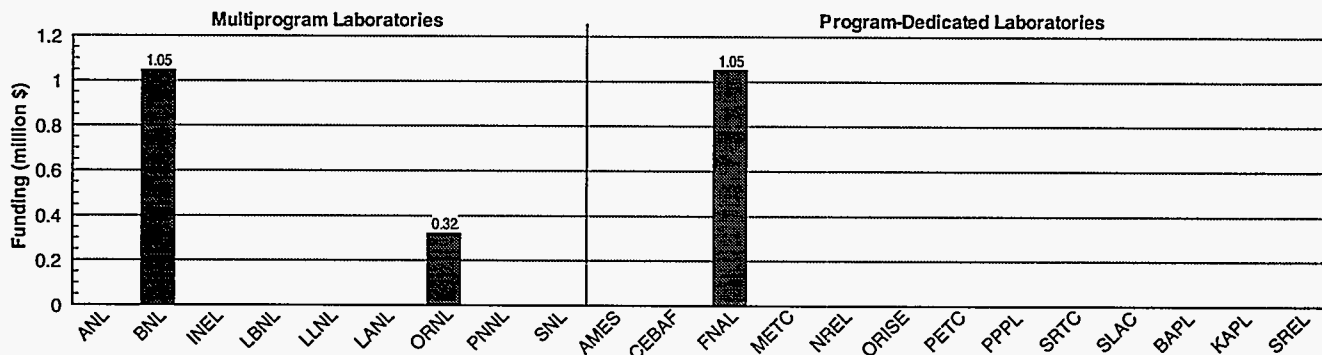
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Radiopharmaceuticals

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Medical Applications
B&R Code: KP060102

Laboratory Complex

Principal Laboratories: BNL, ORNL
Contributing Laboratories: None
Participating Laboratories: LANL, LBNL, ORISE

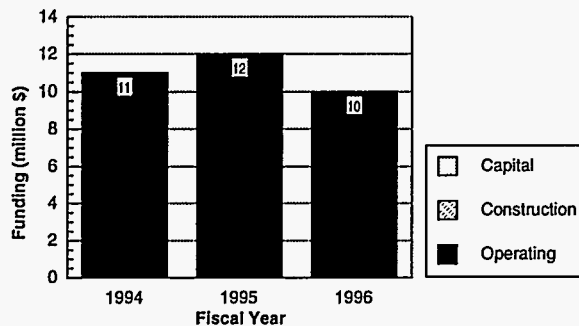
Mission Activity Description

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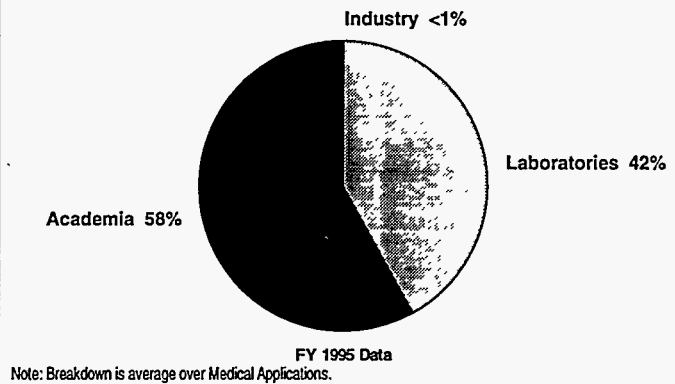
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Radiopharmaceuticals research includes the pursuit of new organic synthesis and genetic engineering approaches to develop molecular probes of high and selective target specificity. Radiolabeling of new medicinal agents and the agents of substance abuse are emphasized. New radiolabeled agents are studied for diagnosis and therapy with special focus on heart, brain, and cancer targeting. Radiopharmaceutical research, in addition to the studies of cancer detection and treatment, and brain and heart metabolism, will also contribute to the diagnosis and therapy of other organs.

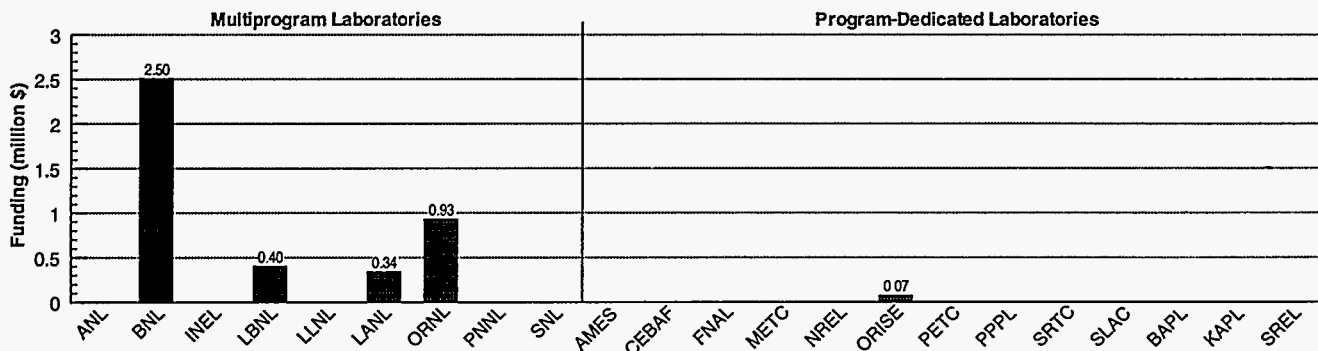
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Medical Imaging Technology

Department of Energy Program

Program: Energy Research
 Office: Health and Environmental Research
 Element: Medical Applications
 B&R Code: KP060103

Laboratory Complex

Principal Laboratories: BNL, LANL, LBNL
 Contributing Laboratories: None
 Participating Laboratories: None

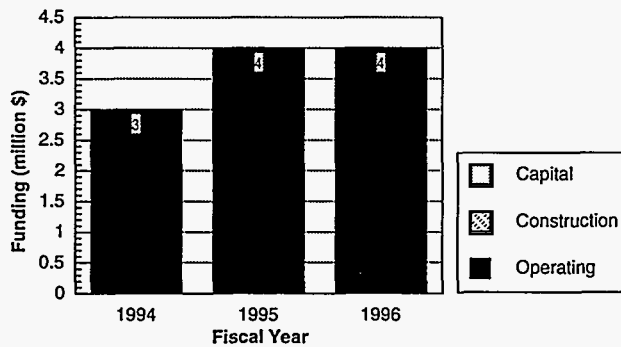
Mission Activity Description

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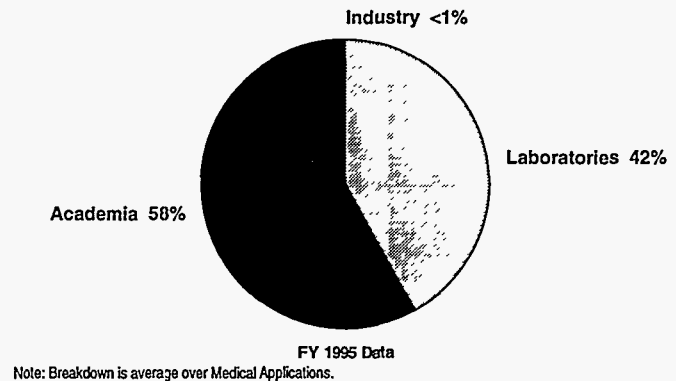
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The Instrumentation program develops improved measurement imaging technology to achieve higher spatial resolution and more accurate quantitation of organ physiology. New technology for fabricating photodiode detector arrays has will be used to assemble positron emission tomography (PET) detector modules with very low electronic noise. The technology will be transferred to a U.S. manufacturer. To overcome the limitation of existing scintillation detectors for PET, a systematic search of promising crystals will be made in collaboration with theoreticians to guide the search.

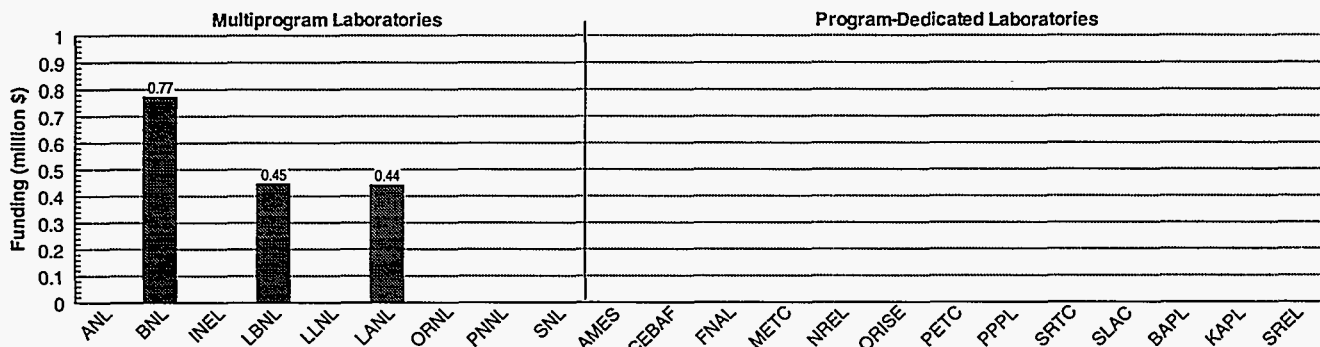
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Clinical Feasibility

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Medical Applications
B&R Code: KP060104

Laboratory Complex

Principal Laboratories: BNL, LBNL
Contributing Laboratories: ORISE
Participating Laboratories: None

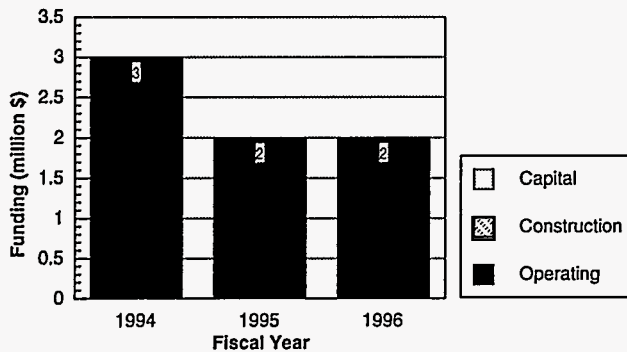
Mission Activity Description

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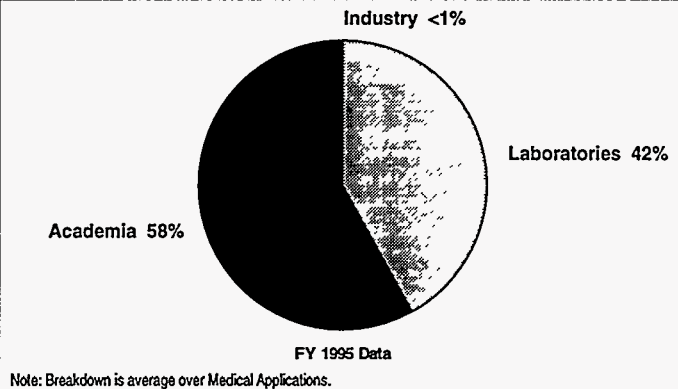
The central goal and objectives of the Medical Applications program are to enhance the Department's nuclear and other energy technologies by introducing recent advances in molecular and structural biology, develop integrated powerful tools of radiotracer agents, positron emission tomography, single photon emission computed tomography, advanced image processing and informatics for noninvasive diagnosis of patients' problems, and the tools of molecular therapies, including genetically engineered monoclonal antibodies and boron carrier compounds.

The Clinical Feasibility effort extends the basic findings from the research laboratory toward the initial investigation of their applicability in human patients. The radioisotope, radiopharmaceutical, and monoclonal antibody agents with promising preliminary biological results through animal screening data will be further developed to study the clinical potential in humans and for technology transfer.

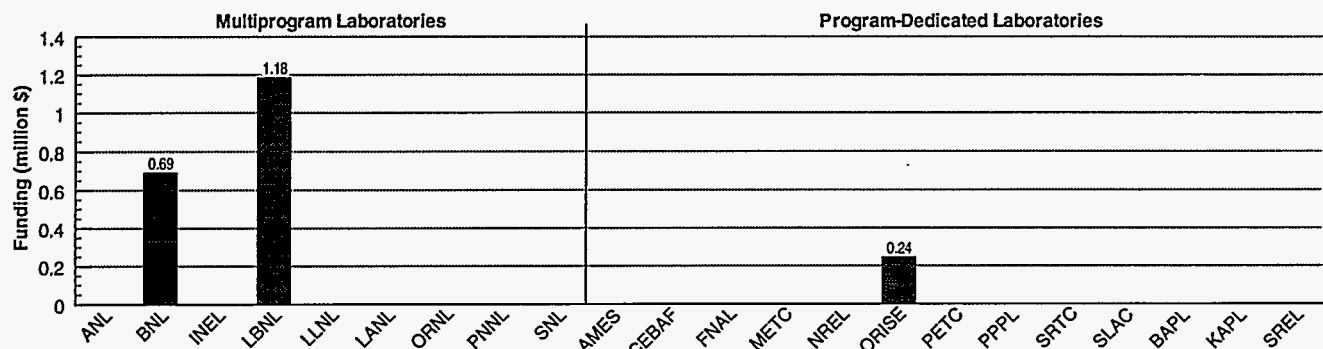
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Boron Neutron Capture Therapy

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Medical Applications
B&R Code: KP060105

Laboratory Complex

Principal Laboratories: BNL, INEL
Contributing Laboratories: None
Participating Laboratories: None

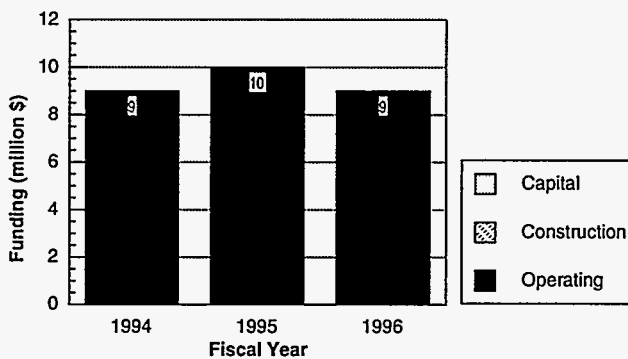
Mission Activity Description

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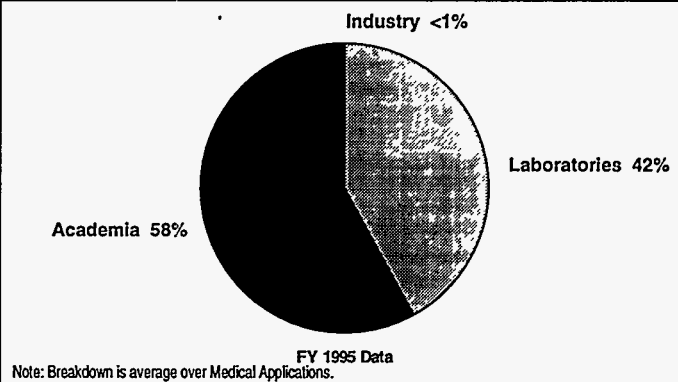
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Radiation therapy research explores the application of new radioactive materials and radiation technology as potential radiation therapy methodologies. In Boron Neutron Capture Therapy, a strong emphasis is placed on conducting human clinical trials, closely coordinated with the Food and Drug Administration, to demonstrate application to the treatment of brain tumors, such as glioblastoma and melanoma. For example, it is anticipated that the compound, boronphenylalanine will advance to Phase II clinical trials using the Massachusetts Institute of Technology reactor, and the fructose derivative of this compound will enter Phase II trials at the upgraded Brookhaven Medical Research Reactor.

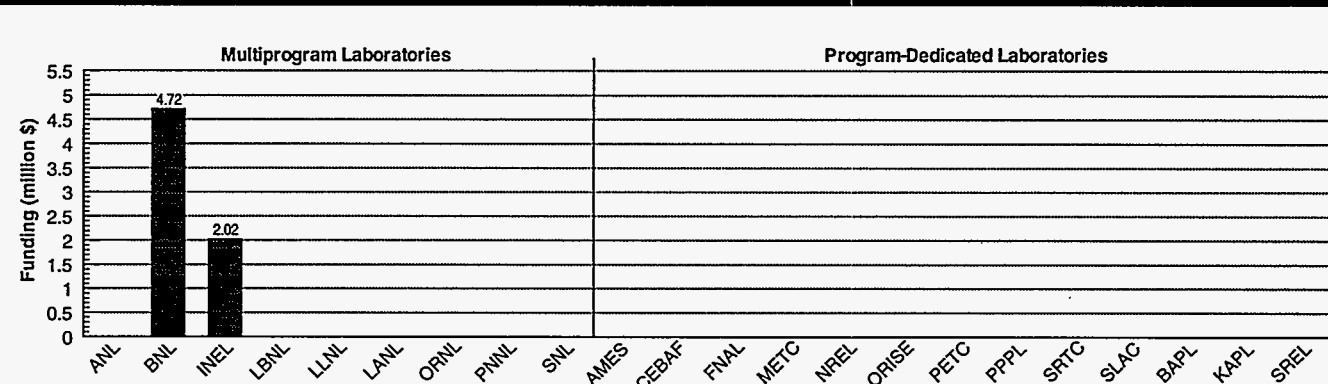
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Molecular Nuclear Medicine

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Medical Applications
B&R Code: KP060106

Laboratory Complex

Principal Laboratories: BNL, LBNL
Contributing Laboratories: None
Participating Laboratories: None

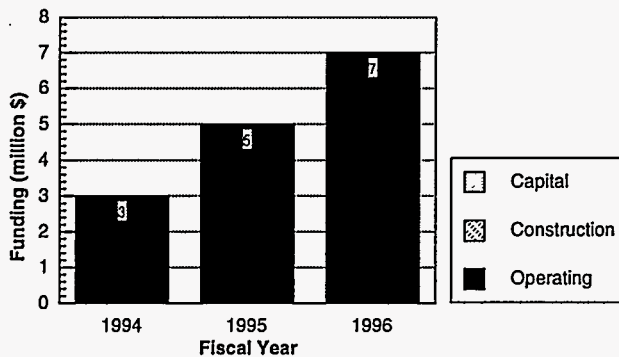
Mission Activity Description

The Medical Applications research program, mandated initially by the Atomic Energy Act of 1946 to promote use of radioactive materials and radiation for medical applications, has provided the scientific and technological foundation for the establishment of nuclear medicine as a major clinical specialty. Research in radioisotope production, radiopharmaceutical chemistry, radioisotope imaging instrumentation together with investigation of a broad range of diagnostic and therapeutic applications demonstrated and validated advanced diagnostic and therapeutic capability and also led to the establishment of a vital radionuclide production, radiopharmaceutical development, and radionuclide instrumentation industry. Technology developed under this program provides a noninvasive capability for detection and localization of small lesions, for quantitative measurement of dynamic organ function, and for selective radioisotope and radiation therapy of cancer and has achieved a reduction in medical costs through, for example, avoidance of unnecessary surgery.

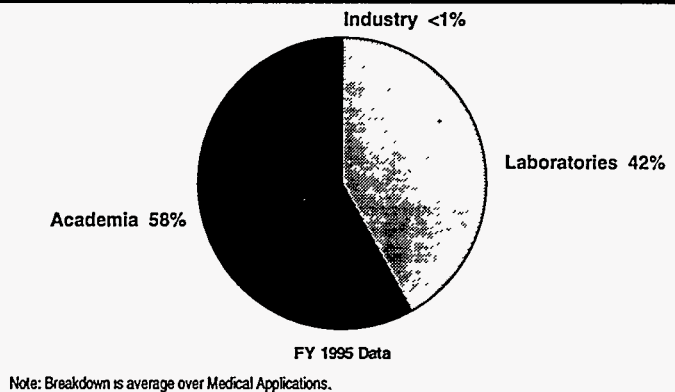
The central goal and objectives of the Medical Applications program are to enhance the Department's nuclear and other energy technologies by introducing recent advances in molecular and structural biology, develop integrated powerful tools of radiotracer agents, positron emission tomography, single photon emission computed tomography, advanced image processing and informatics for noninvasive diagnosis of patients' problems, and the tools of molecular therapies, including genetically engineered monoclonal antibodies and boron carrier compounds.

Molecular Nuclear Medicine research includes investigations of radiolabeled molecular probes for neurotransmitter and neuroreceptor studies, while exploiting new molecular biology approaches for labeling and investigating biological function. This research is directed toward development of advanced nuclear medicine technology and initial exploration of its medical applicability. It complements the National Institutes of Health (NIH) research programs, which are more strongly clinical and diseases oriented. Emphasis continues on nucleic acid, peptide, and genetically engineered protein and antibody probes to study neuroreceptors and neurotransmitters regulating brain function and to study tumor receptors and tumor receptor targeting.

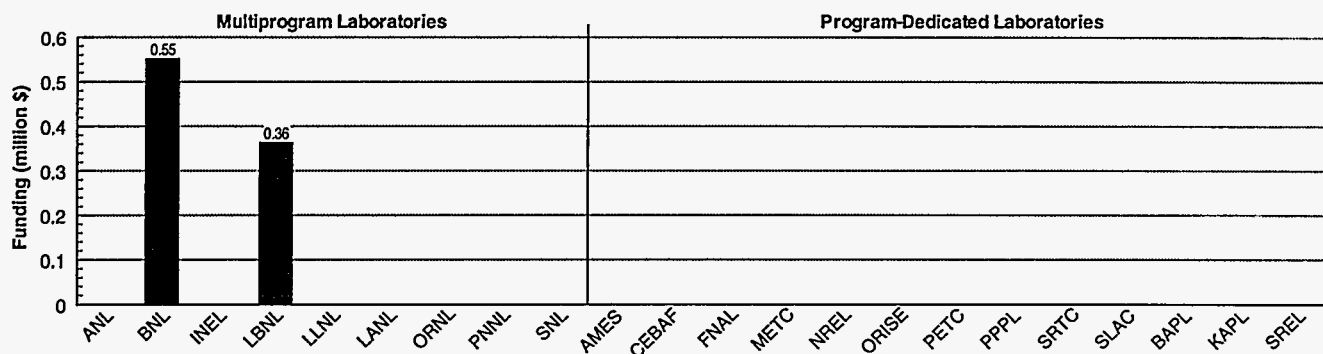
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Advanced Biomedical Science and Technology

Department of Energy Program

Program: Energy Research
Office: Health and Environmental Research
Element: Medical Applications
B&R Code: KP060107

Laboratory Complex

Principal Laboratories: INEL
Contributing Laboratories: None
Participating Laboratories: None

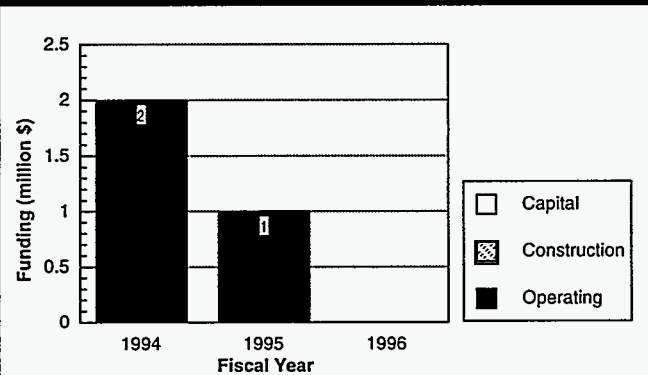
Mission Activity Description

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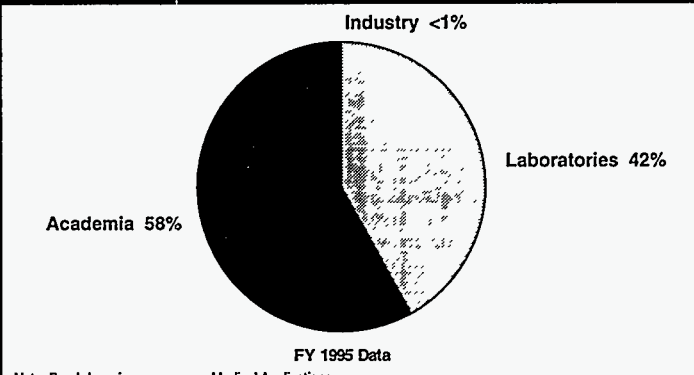
The central goal and objectives of the Medical Applications program are to enhance the Department's nuclear and other energy technologies by introducing recent advances in molecular and structural biology, develop integrated powerful tools of radiotracer agents, positron emission tomography, single photon emission computed tomography, advanced image processing and informatics for noninvasive diagnosis of patients' problems, and the tools of molecular therapies, including genetically engineered monoclonal antibodies and boron carrier compounds.

The long-range goal of the Advanced Biomedical Science and Technology initiative is to develop and facilitate the application and transfer of advanced highly efficient medical technologies and scientific advancements to cost-effective clinical applications for commercialization. This initiative is in response to the need within the United States for a more efficient and cost-effective health care system coupled with the aim of harnessing some of the unique scientific and technological capabilities that have been developed within the defense and nondefense scientific communities to accomplish that end.

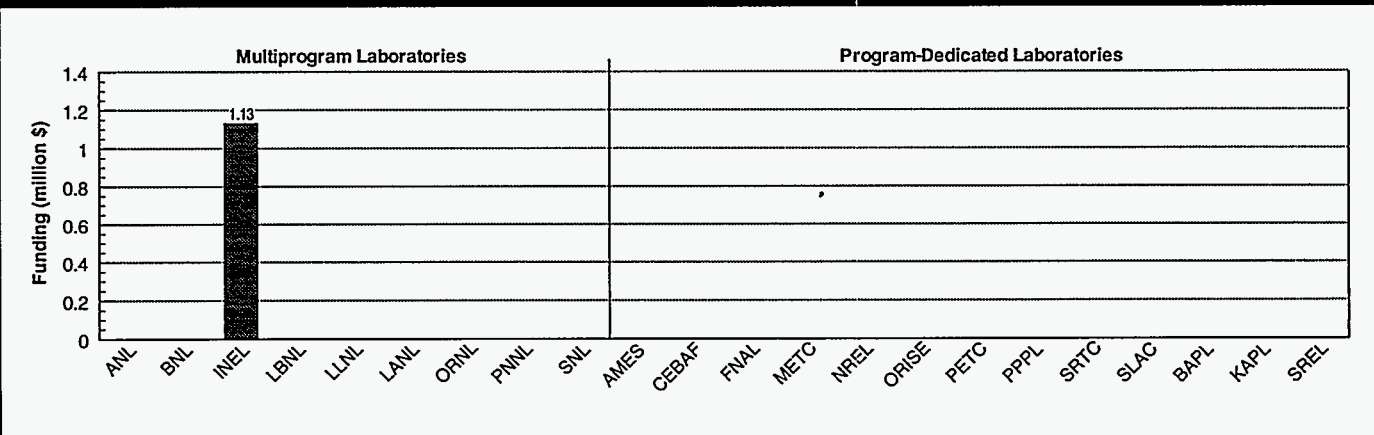
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



High-Energy Physics

Department of Energy Program

Program: Energy Research
 Office: High-Energy Nuclear Physics
 Element: High-Energy Physics
 B&R Code: KA01

Laboratory Complex

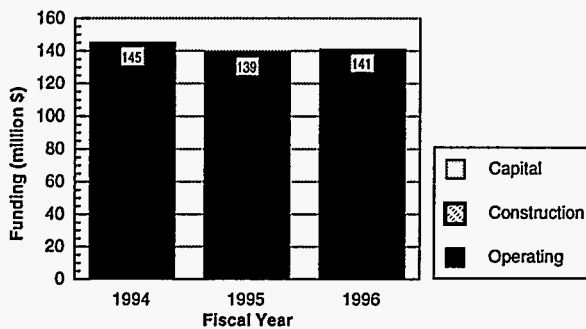
Principal Laboratory: FNAL, LBNL, SLAC
 Contributing Laboratories: ANL, BNL,
 Participating Laboratories: CBAF, LANL, ORNL, PNNL

Mission Activity Description

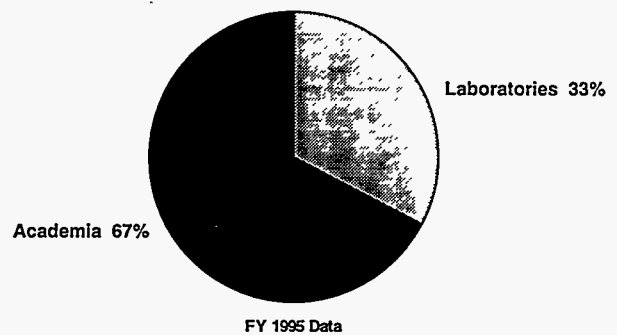
Research in high-energy physics is directed at understanding the nature of matter and energy at the most fundamental level, and the basic forces that govern all processes in nature. The primary goal of the program is to acquire new knowledge and understanding. To carry out this forefront basic research, the program develops advanced technologies for application to accelerators and detectors and new, highly sophisticated approaches to data reduction and analysis. Such technologies often find near-term as well as long-term applications in other fields.

The High-Energy Physics activity supports experimental and theoretical research in high-energy physics. This research probes the nature of matter and energy at the most fundamental level and the characteristics of the basic forces in nature. Experimental research activities include planning, design, fabrication, and installation of experiments; conduct of experiments; analysis and interpretation of data; and publication of results. Theoretical physics research provides the framework for interpreting and understanding observed phenomena and, through predictions and extrapolations based on current understanding, identifies key questions for future experimental explorations.

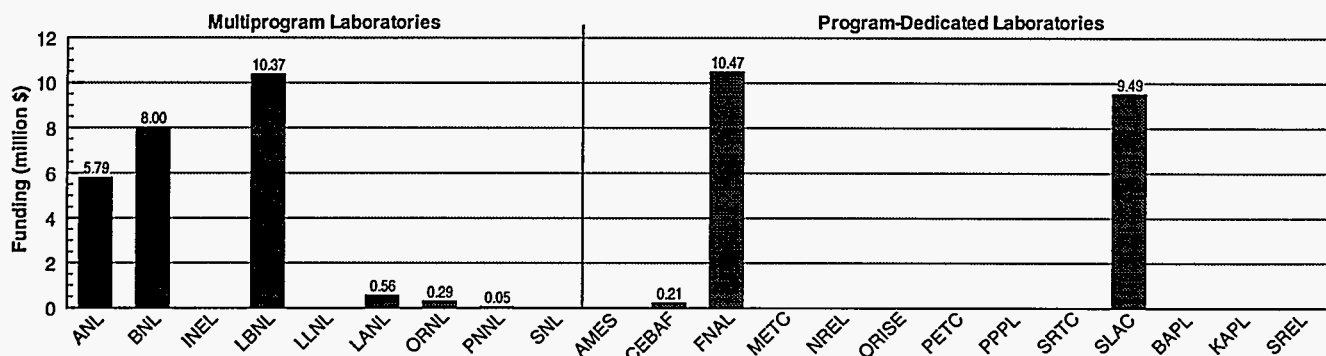
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



High-Energy Physics Facilities Operations

Department of Energy Program

Program: Energy Research
 Office: High-Energy and Nuclear Physics
 Element: High-Energy Physics
 B&R Code: KA02

Laboratory Complex

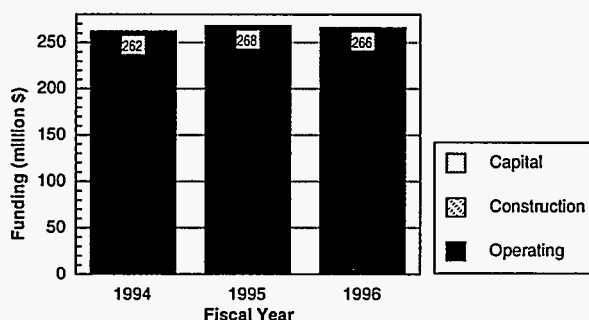
Principal Laboratory: FNAL, SLAC
 Contributing Laboratories: BNL
 Participating Laboratories: ANL, LLNL, ORNL

Mission Activity Description

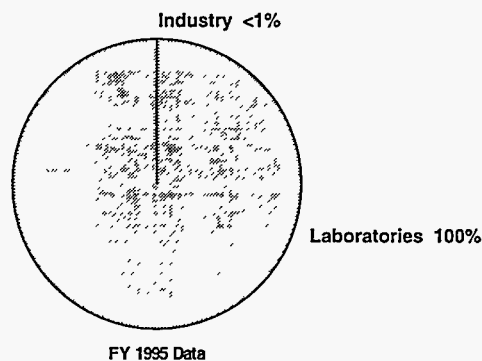
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The High-Energy Physics Facilities Operations activity operates the large accelerator and detector facilities, which are the essential tools that enable scientists in university- and laboratory-based research groups to perform experimental research in high-energy physics. This includes the operation and maintenance of the national laboratory research facilities, including accelerators, colliders, secondary beam lines, detector facilities for experiments, experimental areas, computing, and computing networking facilities.

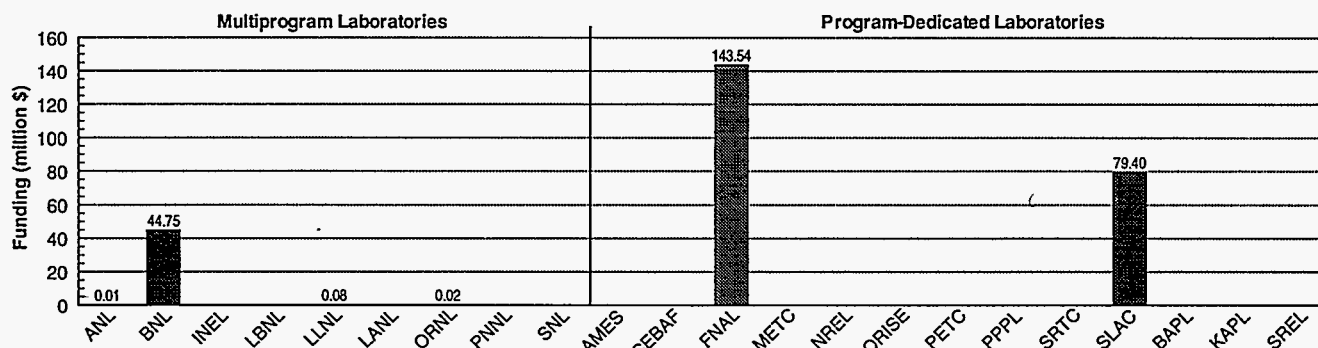
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



High-Energy Technology

Department of Energy Program

Program: Energy Research
Office: High-Energy and Nuclear Physics
Element: High-Energy Physics
B&R Code: KA03

Laboratory Complex

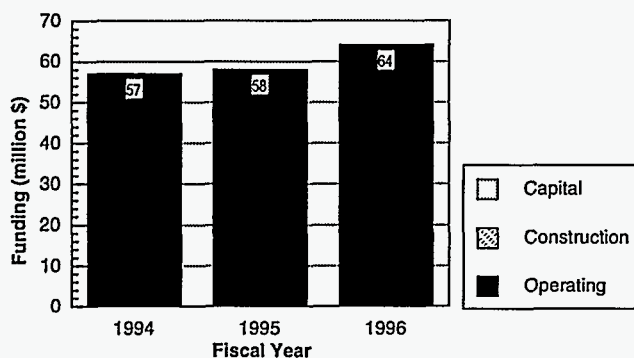
Principal Laboratories: FNAL, LBNL, SLAC
Contributing Laboratories: BNL
Participating Laboratories: ANL, LANL, LLNL, ORNL

Mission Activity Description

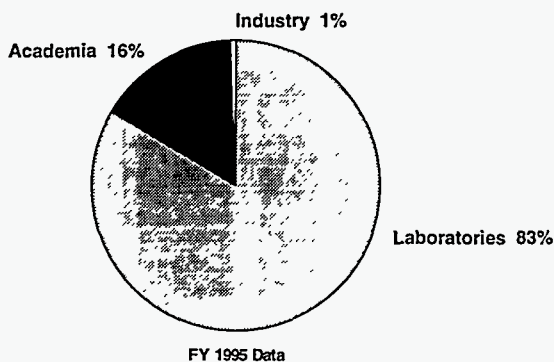
Research in high-energy physics is directed at understanding the nature of matter and energy at the most fundamental level, and the basic forces that govern all processes in nature. The primary goal of the program is to acquire new knowledge and understanding. To carry out this forefront basic research, the program develops advanced technologies for application to accelerators and detectors and new, highly sophisticated approaches to data reduction and analysis. Such technologies often find near-term as well as long-term applications in other fields.

The High-Energy Technology activity performs the specialized advanced technology research and development (R&D) required to sustain and extend the technology base and provide operational support for the highly specialized accelerators, colliding beams facilities, and detector facilities that are essential to the overall high-energy physics program goal of carrying out forefront research. The objectives of this subprogram are to carry out R&D in support of existing accelerator and detector facilities aimed at maintaining and improving their performance parameters and cost effectiveness; carry out R&D in support of planned and proposed projects to maximize their performance goals and cost-effectiveness; carry out R&D to transfer new concepts and technologies into practical application in the high-energy physics context; and carry out R&D to search for and develop new concepts and ideas that could lead to significant enhancements of research capabilities or to significant cost savings in the construction and operation of new facilities.

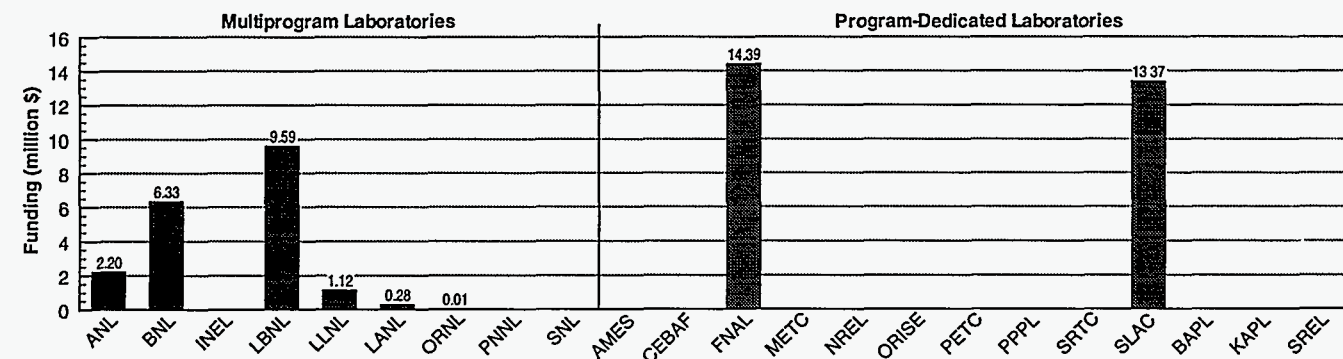
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Medium-Energy Nuclear Physics

Department of Energy Program

Program: Energy Research
 Office: High-Energy Nuclear Physics
 Element: Nuclear Physics
 B&R Code: KB01

Laboratory Complex

Principal Laboratories: CEBAF, LANL
 Contributing Laboratories: None
 Participating Laboratories: ANL, BNL, LLNL

Mission Activity Description

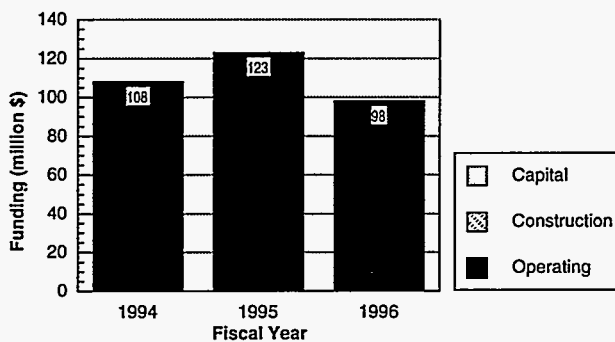
The Medium-Energy Nuclear Physics activity supports academic fundamental research, and operations and research at electron and proton accelerator facilities at the higher energies of interest to nuclear physics. In addition, the activity supports research at accelerators operated by other Department of Energy programs (for example, High-Energy Physics and Basic Energy Sciences) and at other unique domestic or foreign facilities.

Two national accelerator facilities are now operated entirely under the medium-energy activity—the Continuous Electron Beam Accelerator Facility (CEBAF) in Newport News, Virginia, and the Bates Linear Accelerator Center in Middleton, Massachusetts. These accelerator facilities serve a nationwide community of DOE and National Science Foundation-supported scientists from more than 100 American institutions, of which more than 90 percent are universities.

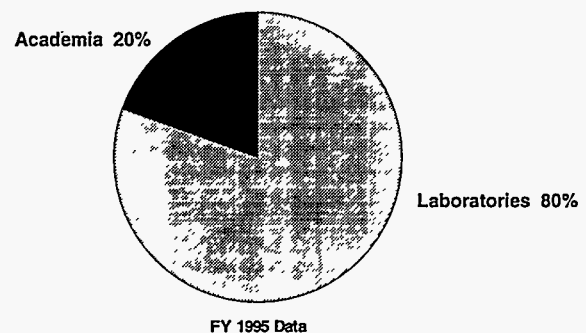
Foreign scientists collaborate in the research programs at both facilities. The research program at the new CEBAF, for example, involves 540 scientists from 17 foreign countries; 81 of these scientists are from Centre European de Recherche Nucleaire (CERN) member states. At CEBAF, foreign collaborators have also made major investments in experimental equipment.

The research programs supported at these facilities are ultimately aimed at achieving an understanding of the structure of the atomic nucleus in terms of quarks and gluons, the objects that apparently combine in different ways to make all the other subatomic particles. Just as important is the achievement of an understanding of the "strong force," one of only four forces in nature, which holds the nucleus of the atom together. Research efforts include studies of the role of excited states of protons and neutrons in nuclear structure, investigations of the role of specific quarks in the structure of protons and neutrons, studies of the symmetries in the behavior of the laws of physics, investigations of how the properties of protons and neutrons change when imbedded in the nuclear medium, measurements with beams of electrons or protons whose "spins" have all been lined up in the same direction (polarizing the beams) to determine unique "structure functions" that pin down particular models of nuclear structure, and studies of how particles interact inside the nucleus.

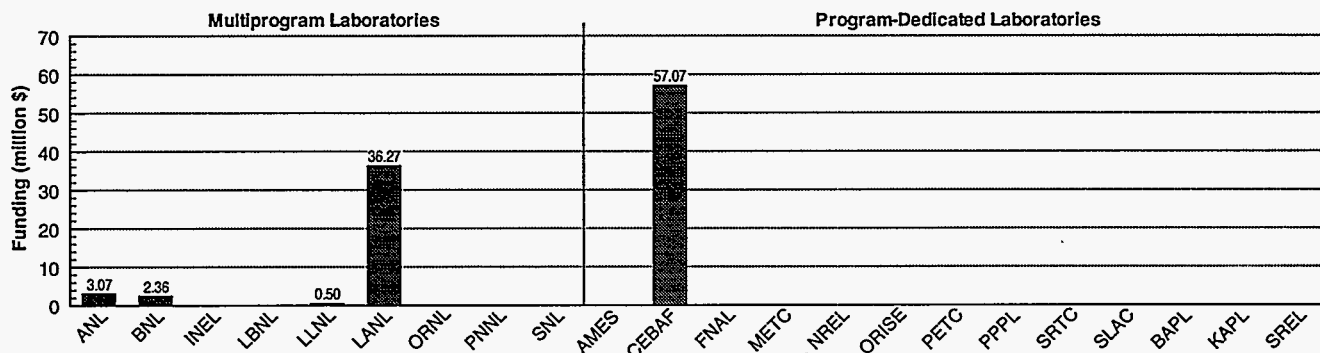
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Heavy-Ion Nuclear Physics

Department of Energy Program

Program: Energy Research
 Office: High-Energy and Nuclear Physics
 Element: Nuclear Physics
 B&R Code: KB02

Laboratory Complex

Principal Laboratories: ANL, BNL, LBNL
 Contributing Laboratories: None
 Participating Laboratories: LANL, LLNL, ORNL

Mission Activity Description

The Heavy-Ion Nuclear Physics subprogram supports research directed at understanding the properties and behavior of atomic nuclei and nuclear matter over a wide range of conditions. These conditions are created in nucleus-nucleus collisions using beams of heavy ions.

Nuclear Structure and Reaction Studies

At low bombarding energies, research is focused on the study of nuclei that are only gently excited (cool nuclear matter), but taken to their limits of deformation by causing the nuclei to spin extremely rapidly, and to their limits of stability by adding or subtracting protons (or neutrons) to form short-lived, proton-rich (or neutron-rich) nuclei. With higher energy heavy-ion beams, sufficient energy can be transferred into a nucleus so that very highly excited nuclei (warm nuclear matter) can be formed and studied.

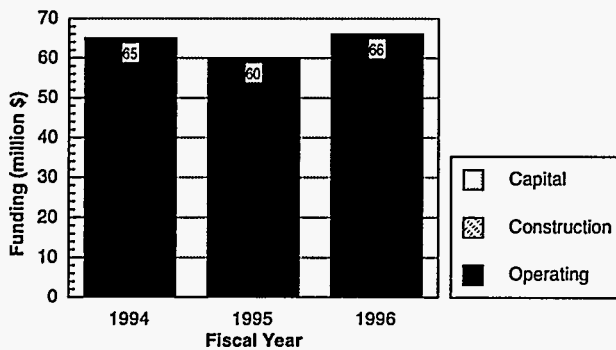
Relativistic Heavy-Ion Research

At relativistic bombarding energies, the properties and behavior of hot dense nuclear matter are studied, with a goal of observing the deconfinement of normal hadronic matter into a new form of matter, a quark-gluon plasma. The Relativistic Heavy-Ion Collider (RHIC), under construction at BNL, will be the world's premier facility for these investigations.

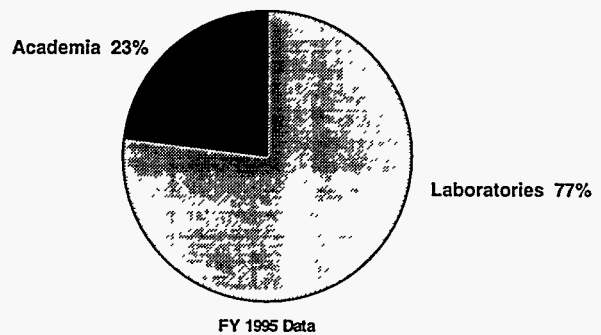
Heavy-Ion Facility Operations and Research and Development

Accelerators located at two universities (Texas A&M and Yale) and three national laboratories (ANL, BNL, and LBNL) are supported and maintained by the heavy-ion nuclear physics subprogram for these studies. The national laboratory facilities are utilized by Department of Energy, National Science Foundation, and foreign-supported researchers whose experiments undergo peer review by program advisory committees prior to approval for beam time.

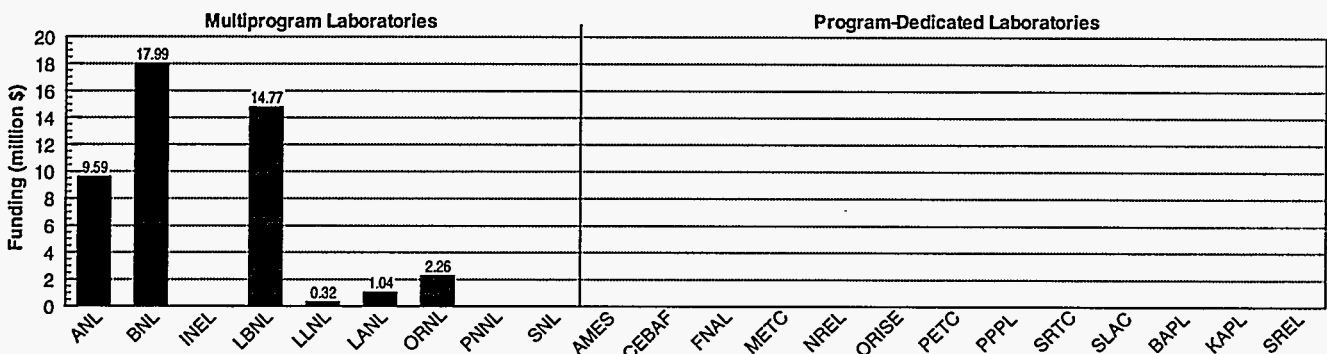
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Nuclear Theory

Department of Energy Program

Program: Energy Research
 Office: High-Energy and Nuclear Physics
 Element: Nuclear Physics
 B&R Code: KB03

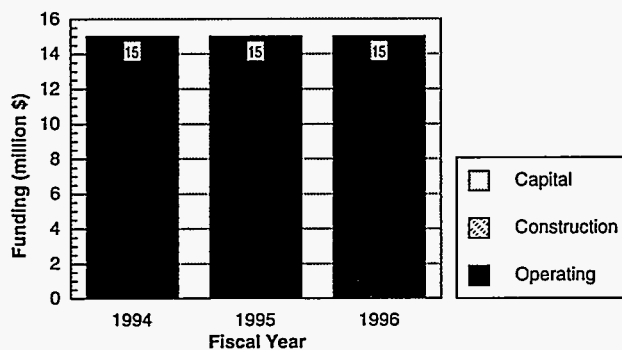
Laboratory Complex

Principal Laboratories: BNL
 Supporting laboratories: ANL, CEBAF, LANL, LBNL, ORNL
 Participating Laboratories: LLNL

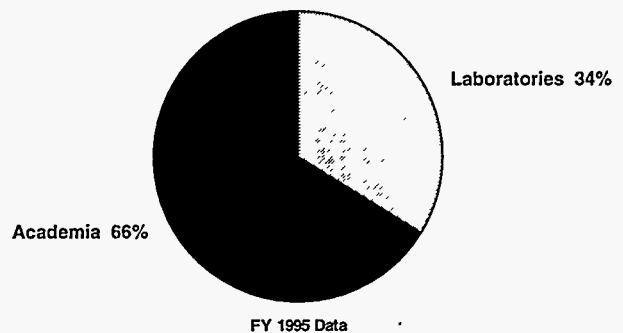
Mission Activity Description

Theoretical Nuclear Physics is a program of fundamental science research to provide new insight into the observed behavior of atomic nuclei. The understanding of nuclear phenomena is prerequisite to understanding the material foundations of the world around us and in our universe. The research ranges from relating the description of elementary constituent particles and the fundamental forces connecting them, to accounting for the collective interactions of nuclei as a whole. The long-range objectives of the Nuclear Theory subprogram are to obtain a comprehensive understanding of the character and structure of nuclear matter at the most fundamental level in terms of the properties of the constituent quarks and gluons, and using this knowledge to further define the relationships between the nucleons embedded in the environment of the nucleus as a whole. Nuclear theory research at universities and national laboratories entails individual efforts that transcend subcategories of nuclear physics. The graduate students and postdocs supported in the Theoretical Nuclear Physics program are highly trained in technical problem-solving techniques and have the flexibility to broadly enhance the Nation's scientific and technical literacy.

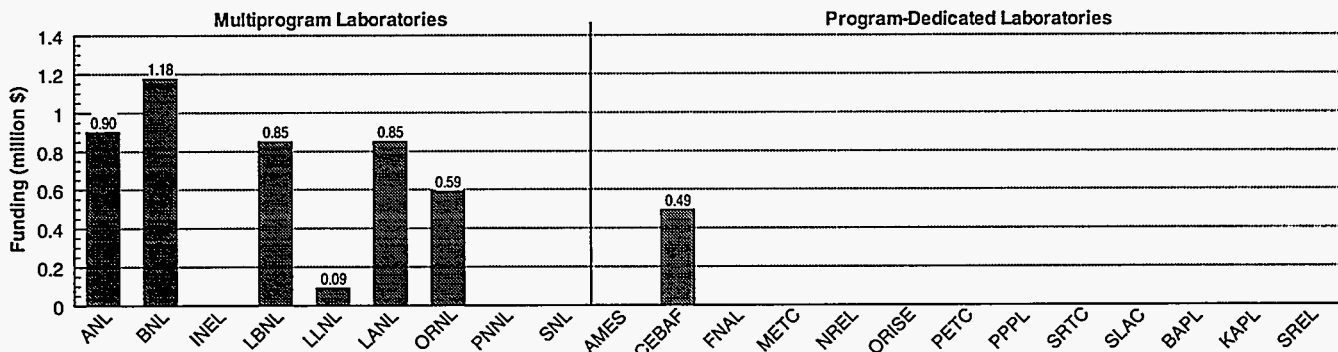
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Low-Energy Nuclear Physics

Department of Energy Program

Program: Energy Research
Office: High-Energy and Nuclear Physics
Element: Nuclear Physics
B&R Code: KB04

Laboratory Complex

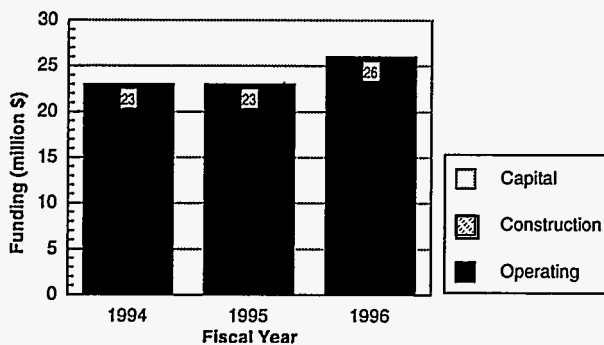
Principal Laboratories: BNL, ORNL
Contributing Laboratories: LBNL
Participating Laboratories: ANL, INEL, LANL, LLNL, ORISE

Mission Activity Description

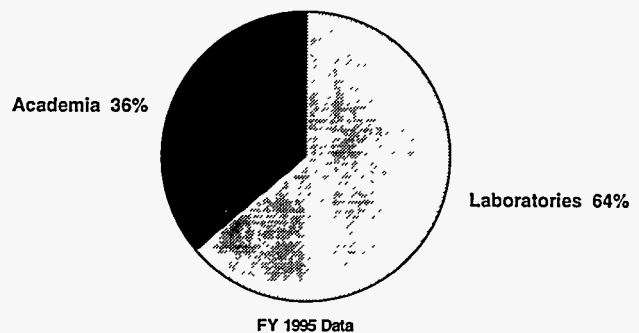
The Low-Energy Nuclear Physics Program supports research addressing issues in nuclear astrophysics, the understanding of the behavior of nucleons at the surface of the nucleus, as well as the collective behavior of the entire ensemble of nucleons acting in consort; nuclear reaction mechanisms; and experimental tests of fundamental symmetries. At present, a major component is the design, construction, and operation of a Radioactive Ion Beams (RIB) facility located at ORNL. Research and service activity topics include:

- **Nuclear Astrophysics**—Astrophysical properties of the Sun are investigated in a joint U.S.-Canadian-British project: the Sudbury Neutrino Observatory. This observatory, a cavity 666 feet in diameter and 110 feet in height, resides 6,800 feet below the Earth's surface. Nuclear reaction rate measurements address theories of the creation of the elements in the "Big Bang."
- **Fundamental Interactions**—Detailed study of the decay of the free neutron, in an experiment termed emit, is being used to investigate the origin and nature of time reversal symmetry violation wherein, contrary to the fundamental laws of classical physics, flow of time can be violated in microscopic systems. This "time reversal symmetry violation" has implications for the fundamental laws of nature and for cosmology.
- **Structure of Nuclei**—Research into the properties of nuclei with uncommon ratios of neutrons to protons is exploring new features of nuclei such as particle emission for ground and excited states. Using special detectors (double sided strip detectors) at different RIB facilities, proton emitters are being identified in some of the heaviest elements as well as the study of competition between gamma ray emission and particle emission from nuclei.
- **Nuclear Information Services**—This activity provides compilation and dissemination of an accurate and complete nuclear data information base that is readily accessible and user oriented. The National Nuclear Data Center at BNL is the central point for U.S. and international coordination.

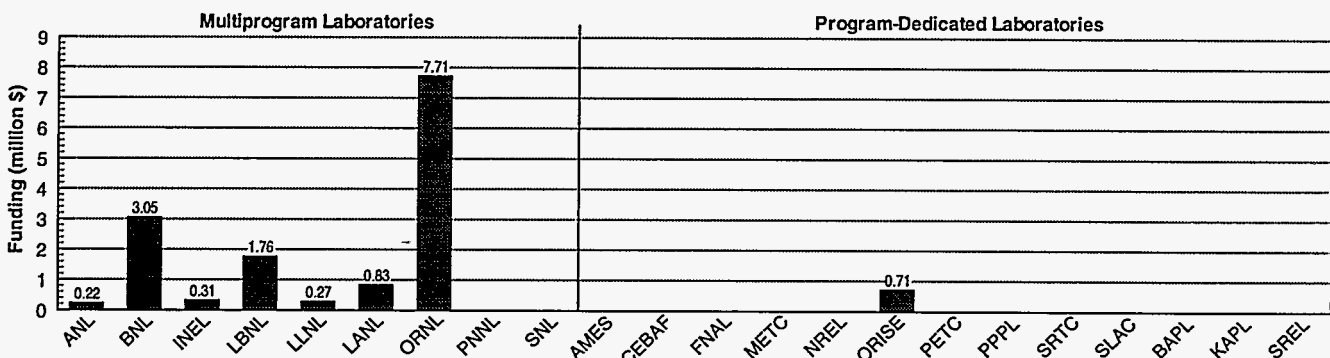
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Energy Research Technology Transfer

Department of Energy Program

Program: Energy Research
 Office: Energy Research
 Element: Technology Transfer
 B&R Code: KU01, KU02

Laboratory Complex

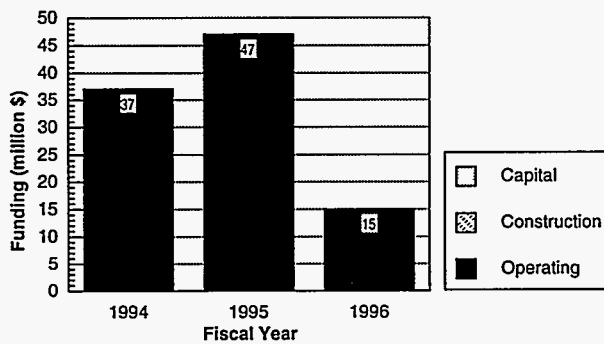
Principal Laboratories: ORNL, LBNL
 Contributing Laboratories: ANL, BNL, PNNL
 Participating Laboratories: Ames, CEBAF

Mission Activity Description

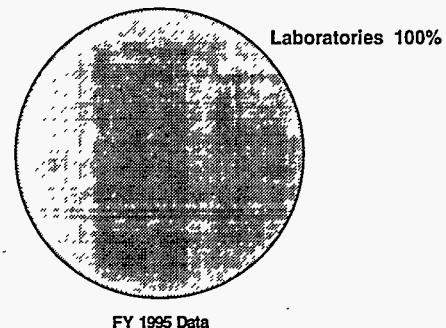
The Energy Research Laboratory Technology Research Program links the Energy Research basic science programs, conducted at the national laboratories, to applied technologies. This is achieved through the leveraged application of laboratory-funded research and development with resources provided by nonprofit institutions, academia, and the private sector. This results in the formation of cost-shared high-risk research collaborations. The following are the program's key goals:

- Reduce technical risk of leading-edge research projects to a point where feasibility can be shown such that applied programs or industry will pursue development on their own
- Provide cost-effective and responsive access to Energy Research laboratory expertise for nonprofit institutions, academia, and the private sector, particularly small businesses
- Increase the core competency knowledge base of the Energy Research laboratories by providing benefit back to the basic science programs

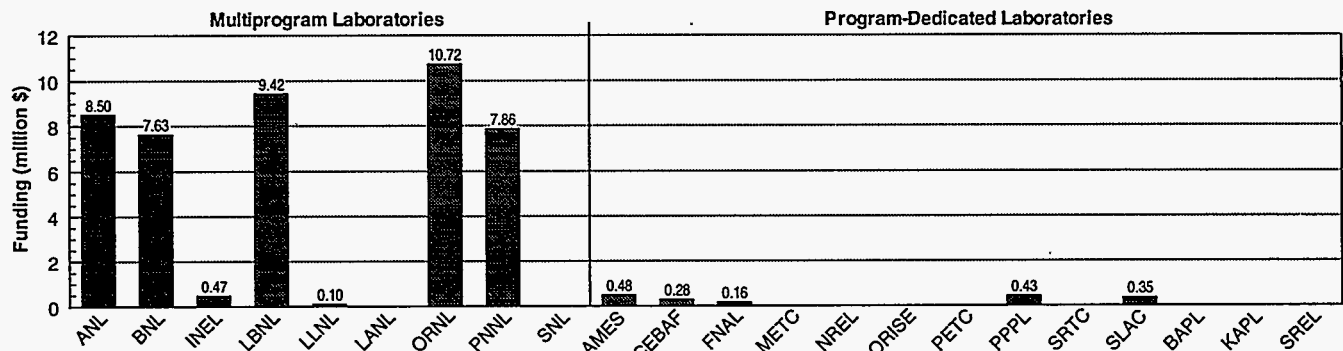
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Applied Physics and Technology

Department of Energy Program

Program: Energy Research
Office: Fusion Energy
Element: Magnetic Fusion Energy
B&R Code: AT05

Laboratory Complex

Principal Laboratory: LLNL
Contributing Laboratories: ORNL, PPPL
Participating Laboratories: ANL, INEL, LANL, LBNL, ORISE

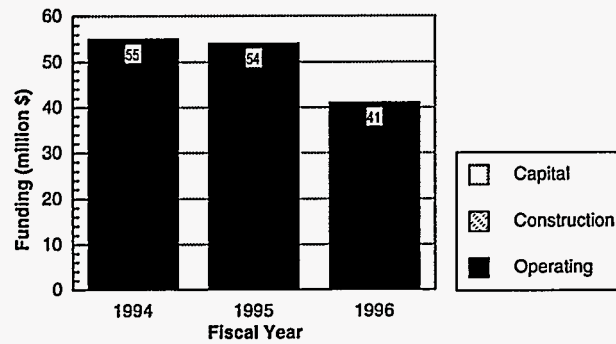
Mission Activity Description

The magnetic fusion program is focused on developing the information that is necessary for the design, construction, and operation of a tokamak fusion powerplant.

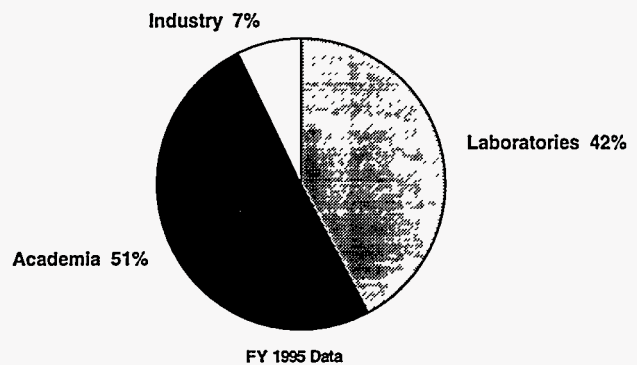
The Applied Plasma Physics activity focuses on the fundamental understanding of plasma behavior in magnetic confinement devices, work that addresses the ignition and burn of a plasma, concept optimization as well as issues that are of critical importance in the development of fusion energy. Ongoing research includes:

- Development of theories and models of plasma behavior in various confinement geometries with heavy emphasis on the leading candidate—the tokamak.
- Development of new approaches in the design and operation of toroidal devices, with emphasis on concepts with powerplant potential or the elucidation of tokamak behavior.
- Support of small- to medium-sized experiments that carry out this research cost-effectively, usually at universities.
- Development of computer codes for analysis and interpretation of data from all the fusion experiments.

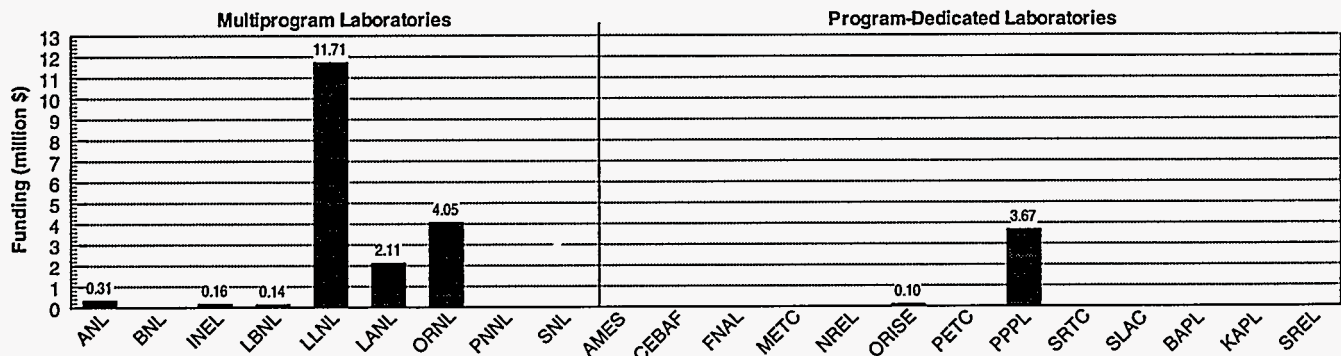
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Confinement Systems

Department of Energy Program

Program: Energy Research
 Office: Fusion Energy
 Element: Magnetic Fusion Energy
 B&R Code: AT10

Laboratory Complex

Principal Laboratory: PPPL
 Contributing Laboratories: None
 Participating Laboratories: ANL, INEL, LANL, LLNL, ORNL, SNL

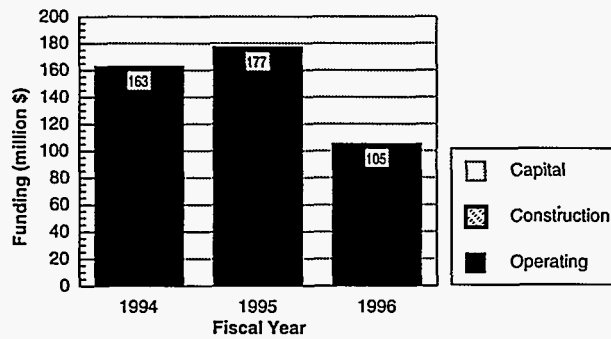
Mission Activity Description

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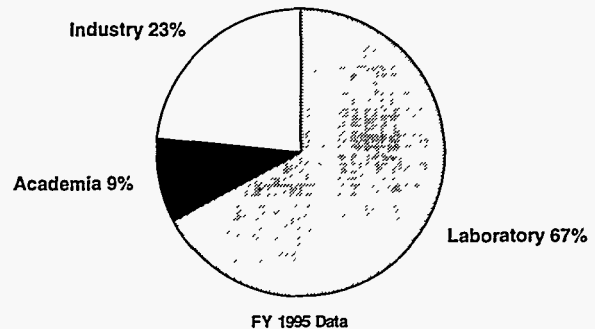
Confinement Systems activities focus on the study of the magnetic confinement of hot plasma in experimental devices of a size and scale relevant to a fusion power plant. This work supports the goal of the U.S. Magnetic Fusion Energy Program to develop fusion powerplants as a technically and economically credible energy source for the 21st century. Ongoing ignition and burn and concept improvement research topics include:

- **Energy Confinement**—Energy confinement is an important physics issue for future fusion devices (for example, the International Thermonuclear Experimental Reactor, or ITER) for achieving a self-sustaining fusion reaction (ignition).
- **Plasma Heating**—Research of technologies (for example, neutral beams and/or radio-frequency waves) to heat the plasma to understand its behavior in order to improve energy confinement.
- **Plasma Equilibrium and Stability**—Research on equilibrium and stability is concentrated on developing designs and operating conditions that theory predicts will maximize the plasma pressure confined by practical magnets.
- **Power Exhaust**—The most critical design issue for the next-generation devices is power exhaust/particle control. Both alpha particles (helium nuclei) and large amounts of energy generated by fusion reactions must be exhausted from the vacuum vessel and the deuterium-tritium fuel must be replenished. Research is under way to develop methods to remove both the plasma power and the leftover alpha particles with minimal impurity generation.

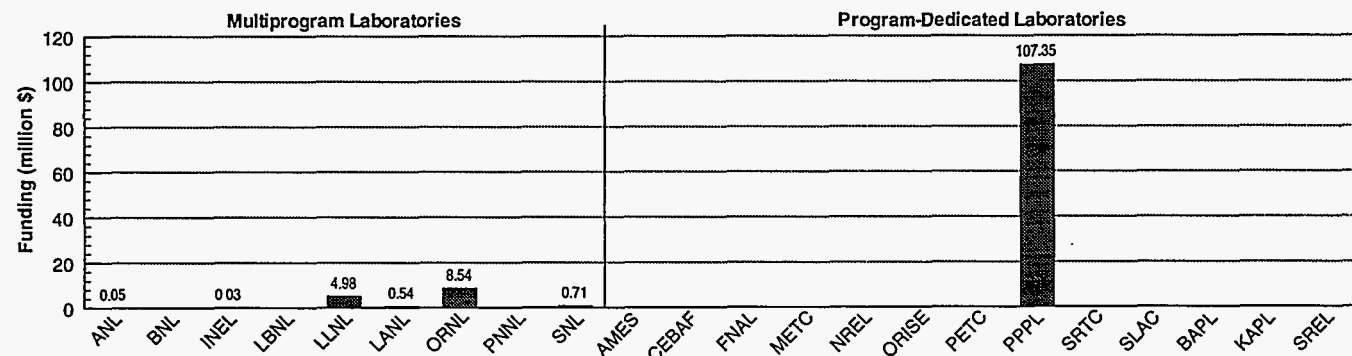
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



ITER and Technology Development

Department of Energy Program

Program: Energy Research
Office: Fusion Energy
Element: Magnetic Fusion Energy
B&R Code: AT15

Laboratory Complex

Principal Laboratory: ORNL
Contributing Laboratories: ANL, LLNL, SNL
Participating Laboratories: BNL, INEL, LANL, ORISE, PNNL, PPPL

Mission Activity Description

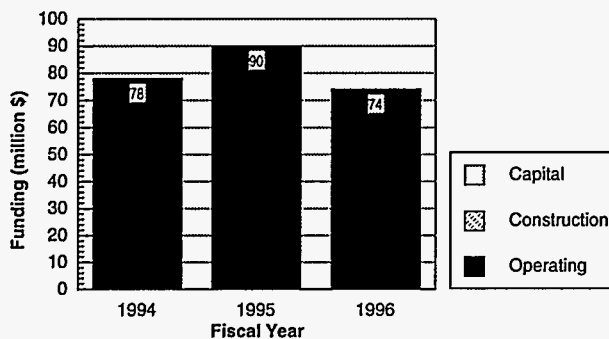
The ITER and Technology Development activity conducts research and development to establish the information and technology data necessary for current and future fusion facilities and projects, including the International Thermonuclear Experimental Reactor (ITER).

The ITER program is being carried out by the European Union, Japan, the Russian Federation, and the United States to design ITER and conduct research and development that will allow the four parties to decide whether to proceed into the construction phase. The ITER device is intended to demonstrate the scientific and technological feasibility of fusion.

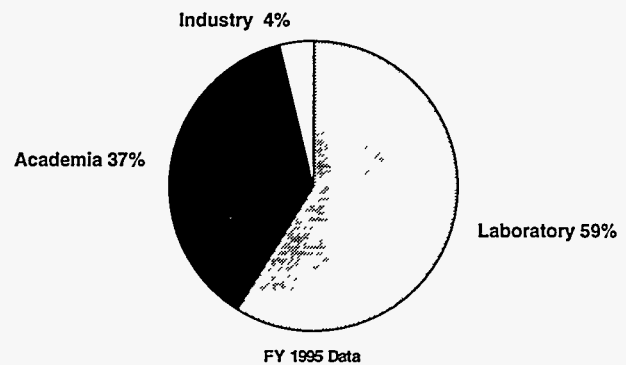
The ITER and Technology Development activity includes:

- Selection and development of materials and the testing of effects of radiation and heat on components and the removal of heat in fusion systems for ITER.
- Development of superconducting magnets to confine and control the plasma location and shape.
- Safety and environmental attractiveness, maintenance, reliability and quality assurance of ITER and other fusion applications.
- Fusion fuel-cycle development, including the development of methods of ensuring that a fusion reactor will be self-sustaining in tritium, cleanup and recycling of fusion plasma exhaust, and reinjection of the fusion fuel into the fusion plasma.
- Plasma heating and current drive systems to provide the heat to initiate the fusion reaction and to control the dynamics of and current distribution within the reacting fusion plasma.
- Plasma interactions with material surfaces that surround the plasma so that the surfaces can withstand contact with the plasma and that material from the walls does not adversely affect the plasma.

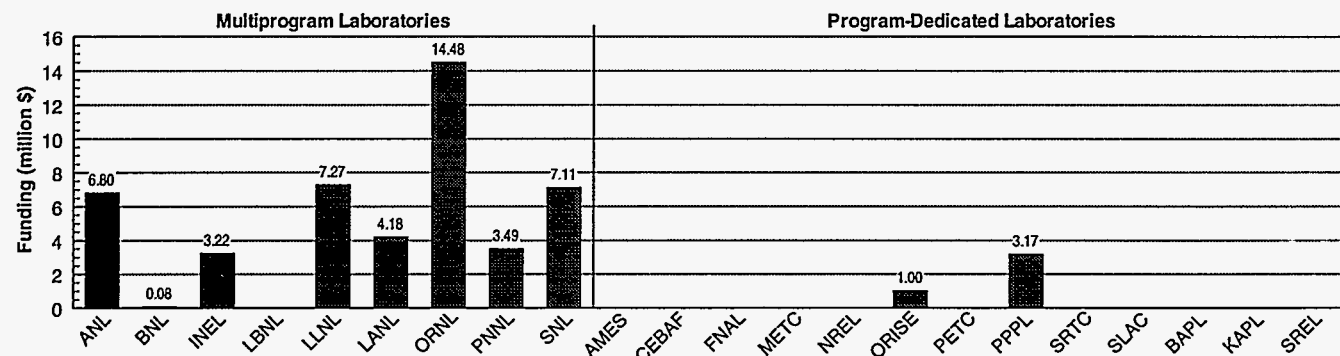
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Ion Driver Research

Department of Energy Program

Program: Energy Research
 Office: Fusion Energy
 Element: Inertial Fusion Energy
 B&R Code: AT2510

Laboratory Complex

Principal Laboratory: LBNL
 Contributing Laboratories: LLNL
 Participating Laboratories: None

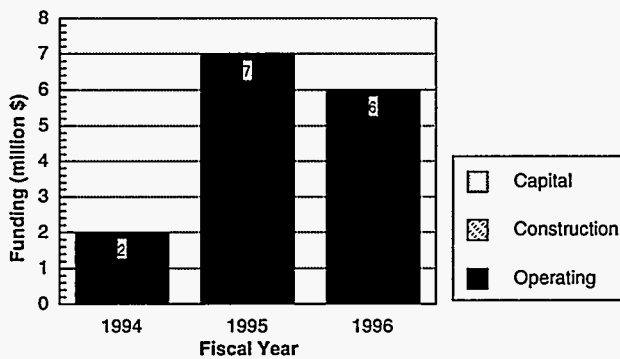
Mission Activity Description

The Inertial Fusion Energy (IFE) activities focus on obtaining fundamental information needed for the design of a demonstration powerplant based on the concept of a small pellet filled with deuterium and tritium that is compressed by heavy ions produced in a high-energy accelerator.

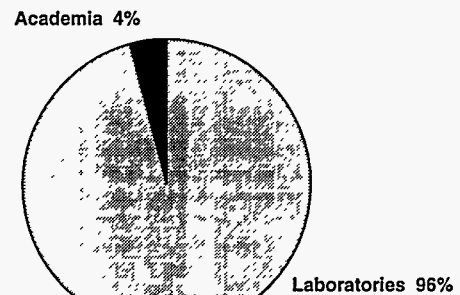
Development of inertial fusion as an energy source requires specific underpinning technical information. First, the amount and nature of energy required to initiate thermonuclear burn of laboratory targets must be determined. An important part of this information is how much gain, or energy multiplication, can be obtained from laboratory inertial fusion. This ignition and gain information is expected to come from the target physics program and the National Ignition Facility carried out under Defense Programs within DOE. Second, a high-intensity energy source (driver) that has high efficiency and can be reliably pulsed several times per second must be developed in order to use laboratory ignition in energy applications. A heavy-ion accelerator has been consistently identified as the best candidate driver. The inertial fusion energy program will conduct the physics tests of the heavy-ion beam concept. The inertial fusion program consists of three activities: ion-driver research, chamber propagation, and target design.

Ion Driver Research aims to resolve the physics issues of the acceleration and transport of intense heavy ion beams that can be tightly focused. Ongoing research topics include beam-current amplification and the electric and magnetic transport of intense ion beams.

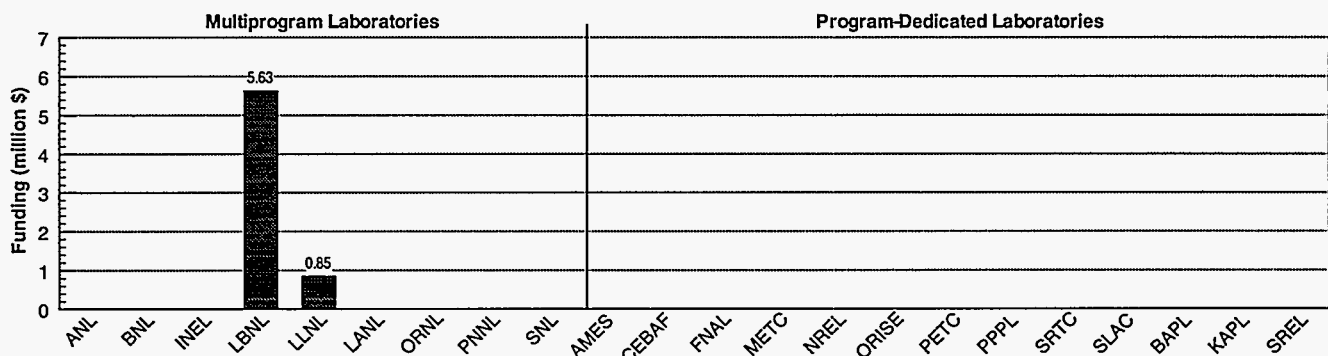
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Chamber Propagation

Department of Energy Program

Program: Energy Research
Office: Fusion Energy
Element: Inertial Fusion Energy
B&R Code: AT2540

Laboratory Complex

Principal Laboratories: LLNL
Contributing Laboratories: PPPL
Participating Laboratories: SLAC

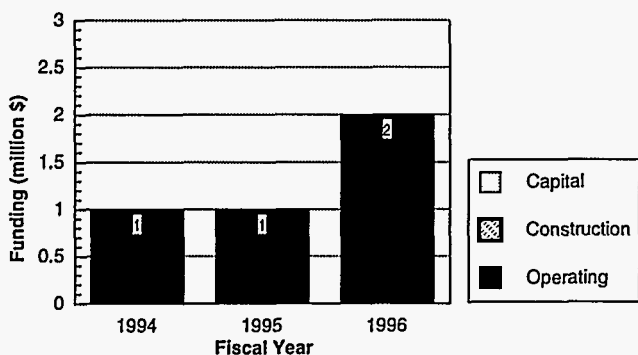
Mission Activity Description

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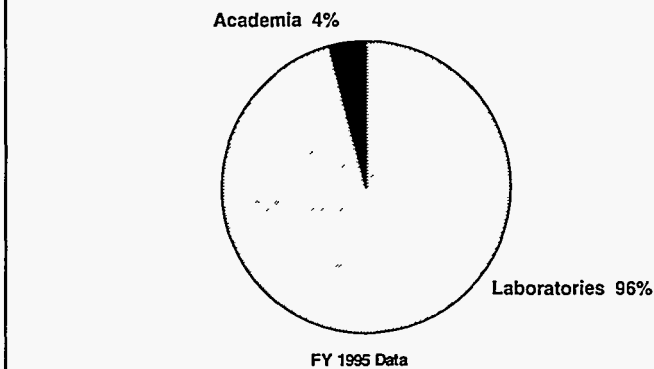
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In the Chamber Propagation element, experiments and reliable computer simulations are being developed for understanding the focusing and transport of intense, high energy ion beams onto millimeter-sized targets under the partial vacuum conditions expected in a fusion chamber.

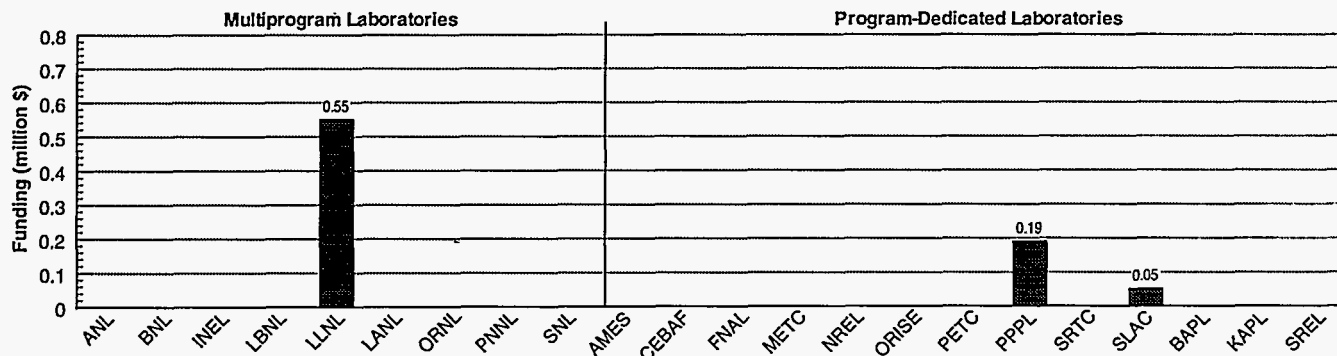
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Target Design

Department of Energy Program

Program: Energy Research
 Office: Fusion Energy
 Element: Inertial Fusion Energy
 B&R Code: AT2550

Laboratory Complex

Principal Laboratories: LLNL
 Contributing Laboratories: None
 Participating Laboratories: None

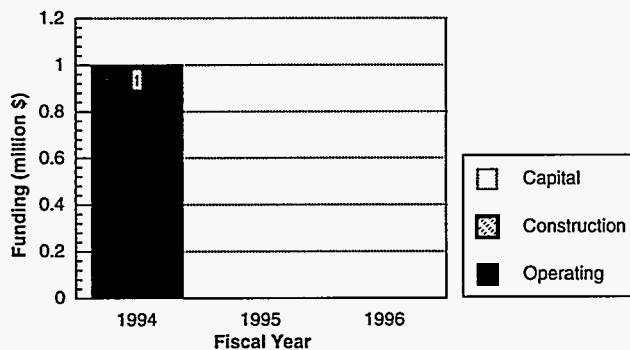
Mission Activity Description

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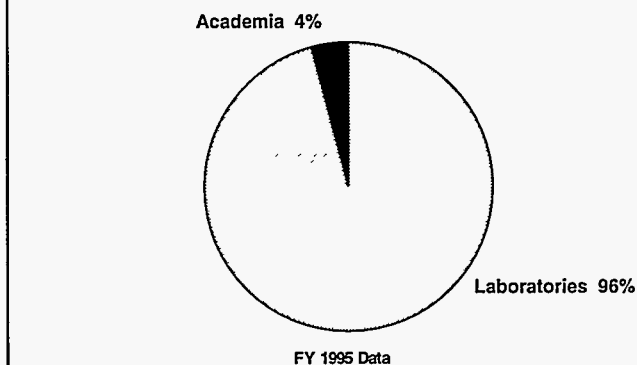
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The IFE Target Design element focuses on the design of low-cost, high-yield, cryogenic targets for heavy ion beam systems. Heavy ion beams are being designed in close collaboration with the Department's Office of Defense Programs.

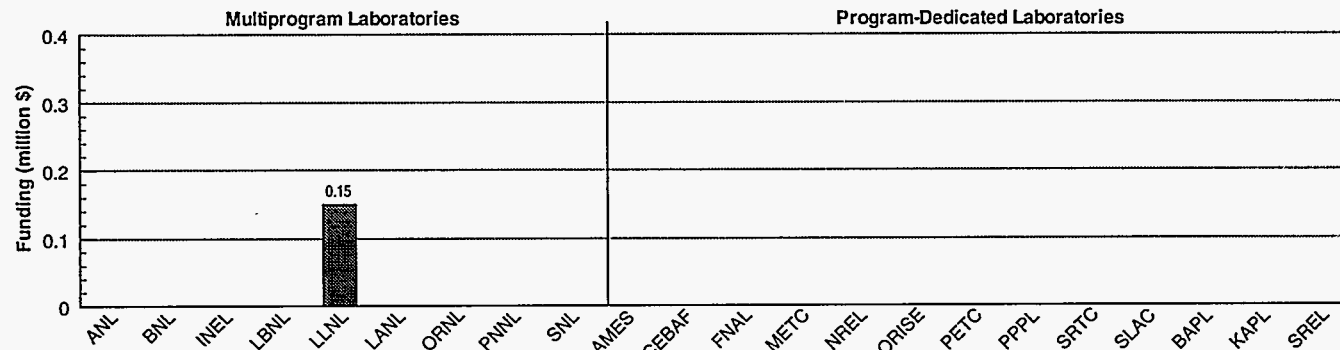
Funding History



Laboratory-Academia-Industry Participation



Fiscal Year 1995 Funding Profile



Note: Because of rounding 1995 Funding does not appear in Funding History graph