The DOE National Laboratories

Brookhaven National Laboratory
Community Advisory Council

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Brookhaven Site Office
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Today’s DOE Laboratories

Why do we have national laboratories?

Couldn’t we simply outsource R&D to universities and industry?
Why do we have National Laboratories?

• Execute long-term government scientific and technological missions, often with complex security, safety, project management, or other operational challenges;

• Develop unique, often multidisciplinary, scientific capabilities beyond the scope of academic and industrial institutions, to benefit the Nation’s researchers and national strategic priorities; and

• Develop and sustain critical scientific and technical capabilities to which the government requires assured access.
Why do we have National Laboratories?

• To perform missions of national interest
• To perform “government only” missions
• To design, build and operate specialized scientific facilities that industry and academia will not/cannot
  — Usually very expensive to build and operate
  — Mostly available to user communities (academia, industry, national labs, others)
  — Designed and operated to meet user community needs
DOE and Its Predecessors and the Formation of the National Laboratories

- **1942-1946** Manhattan Project, War Department Army Corps of Engineers
  - Wartime weapons development
  - Foundations of first DOE multi-purpose national labs

- **1946-1974** Atomic Energy Commission created by the 1946 Atomic Energy Act (P.L. 79-585)
  - Research in basic nuclear processes, nuclear reactor technologies, use of nuclear materials for variety of purposes
  - Establishment of several DOE national labs

- **1974-1977** Energy Research and Development Administration, a new energy R&D agency motivated by Arab oil embargo and created by (P.L. 93-438)
  - Research expands to include solar, fossil, geothermal, synthetic fuels, transmission, conservation, etc.

- **1977-present** Department of Energy (P.L. 95-91)
  - Separation of management oversight of weapons and non-weapons labs and separation of basic and applied research
  - Several DOE labs undergo transition to “open” labs with thousands of external visitors/users annually
Big Science and the Office of Science

• Big science was born at the labs after WWII.

• Over time, big science begat the large suite of Office of Science user facilities.

• These facilities transformed the nature of the labs, and they define the Office of Science today.
Today’s DOE Laboratories

[Map of DOE Laboratories in the United States]
DOE Laboratory Complex

- Management model:

  Federally Funded Research and Development Center (FFRDC)
  - Government-Owned Contractor-Operated (GOCO)
  - Federal program direction/oversight from HQ and Federal “site offices”
  - (except Fossil Energy’s National Energy Technology Laboratory, which is Government-Owned Government-Operated (GOGO))

- Most Labs receive funds from multiple sources

- Each Lab is stewarded by one headquarters program office

  - 10 Office of Science (Ames, Argonne, Berkeley, Brookhaven, Fermilab, Jefferson Lab, Oak Ridge, Princeton, PNNL, SLAC)
  - 3 NNSA (Los Alamos, Livermore, Sandia)
  - 1 Energy Efficiency & Renewable Energy (NREL)
  - 1 Environmental Management (Savannah River)
  - 1 Nuclear Energy (Idaho)
  - 1 Fossil Energy (NETL)
DEPARTMENT OF ENERGY

Office of the Secretary
Dr. Ernest J. Moniz
Secretary
Daniel B. Poneman,
Deputy Secretary

Chief of Staff

Federal Energy
Regulatory Commission
Inspector General

Office of the Under Secretary for Nuclear Security
Frank G. Klotz
Under Secretary for Nuclear Security

National Nuclear Security Administration

Office of the Under Secretary for Science & Energy
Vacant
Under Secretary for Science and Energy

Office of Science
Assistant Secretary for Energy Efficiency and Renewable Energy
Assistant Secretary for Nuclear Energy
Assistant Secretary for Electricity Delivery and Energy Reliability
Indian Energy Policy and Programs

Office of the Under Secretary for Management & Performance
Vacant
Under Secretary for Management and Performance

National Laboratory Operations Board
Associate Under Secretary for Environment, Health, Safety & Security
Management
Chief Human Capital Officer
Chief Information Officer
Economic Impact & Diversity
Hearings & Appeals
Assistant Secretary for Environmental Management
Legacy Management

Advanced Research Projects Agency - Energy
Bonneville Power Administration
Southwestern Power Administration
Southwest Area Power Administration

Assistant Secretary for International Affairs
Assistant Secretary for Congressional & Intergovernmental Affairs
General Counsel
Chief Financial Officer
Independent Enterprise Assessments
Energy Policy & Systems Analysis
Intelligence & Counterintelligence
Loan Programs Office
Public Affairs
Small and Disadvantaged Business Utilization

= Stewards of laboratories

05 May 2014
The DOE Portfolio

Weapons Activities (WA)
- 3 (very large) labs

Environmental Management (EM)
- 1 lab

Science
- 10 labs, ranging from large to small

Nuclear Nonproliferation (NN)
- Naval Reactors (NR)
- Office of Administration (OA)

Energy Efficiency & Renewable Energy (EERE)
- Office of Nuclear Energy (NE)
- Office of Electricity Delivery and Energy Reliability (OE)
- Office of Energy Information and Administration (EIA)

Legacy Management (LM)
- Advanced Research Projects Agency (ARPA-E)

Credit: DOE Office of the Chief Financial Officer
### Basic Energy Sciences
- Understanding, predicting, and ultimately controlling matter and energy flow at the electronic, atomic, and molecular levels

### Advanced Scientific Computing Research
- Delivering world leading computational and networking capabilities to extend the frontiers of science and technology

### Biological and Environmental Research
- Understanding complex biological, climatic, and environmental systems

### Fusion Energy Sciences
- Building the scientific foundations for a fusion energy source

### High Energy Physics
- Understanding how the universe works at its most fundamental level

### Nuclear Physics
- Discovering, exploring, and understanding all forms of nuclear matter
Research and Facilities in the Office of Science

Funding = $5B

Major Items of Equipment
Facility Construction
Facility Operations

Support for 25,000 Ph.D.s, grad students, undergrads, engineers, and support staff

The world's largest collection of scientific user facilities with over 26,000 users /yr

Energy Frontier Research Centers, Energy Innovation Hubs, Bioenergy Research Centers

Research
(About 1/3 of the research is sited at universities)
Office of Science User Facilities

31 world-leading facilities serving over 29,000 researchers annually

- supercomputers,
- high intensity x-ray, neutron, and electron sources,
- nanoscience facilities,
- genomic sequencing facilities,
- particle accelerators,
- fusion/plasma physics facilities,
- and
- atmospheric monitoring capabilities.

- Open access; allocation determined through peer review of proposals
- Free for non-proprietary work published in the open literature
- Full cost recovery for proprietary work
Work for Others

• National Labs are authorized to conduct work for “others” or non-DOE customers provided:
  — Work is consistent with lab mission and capabilities
  — Lab does not compete with industry or commercially available services
  — Restrictions on pricing and future liabilities

• Important source of capabilities for the nation

• Important and often significant source of revenue for the labs
Characteristics of a National Lab

• Size and location
• Core capabilities
• Funding sources
• Facilities
Office of Science Laboratories

Quick Facts

- Location: Ames, Iowa
- 8 acres and 12 buildings
- 310 Full Time Employees
- 149 Students

FY14 Budget (enacted): $33M

Core Capabilities

- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Applied Materials Science and Engineering

FY 2012 Funding by Source (Costs in $M):

- BES, $22.3
- WFO, $4.4
- EERE, $3.1
- Other SC, $3.7
- NNSA, $0.3
- DOE, $2.9
- Other

DiS = Department of Homeland Security
EERE = DOE Office of Energy Efficiency and Renewable Energy
EM = DOE Office of Environmental Management
NE = DOE Office of Nuclear Energy
NNSA = National Nuclear Security Administration
WFO = Work for Others

Office of Science (SC) Programs:

- ASCR = Advanced Scientific Research Computing
- BES = Basic Energy Sciences
- BER = Biological and Environmental Research
- FES = Fusion Energy Sciences
- HEP = High Energy Physics
- NP = Nuclear Physics
Office of Science Laboratories

FY14 Budget (enacted): $559M

Quick Facts
- Location: Argonne, Illinois
- 1,500 acres and 99 buildings
- 3,402 Full Time Employees
- 812 Students
- 5,525 Facility Users
- 979 Visiting Scientists

FY 2012 Funding by Source (Costs in SM):

DHS = Department of Homeland Security
EERE = DOE Office of Energy Efficiency and Renewable Energy
EM = DOE Office of Environmental Management
NE = DOE Office of Nuclear Energy
NNSA = National Nuclear Security Administration
WFO = Work for Others

BES, 224.8
WFO, 90.7
ASC, 61.7
BER, 27.6
EM, 20.2
EERE, 77.5
NE, 27.1
NP, 34.1
SC, 52.3
NNNSA, 78.8
Other, 9.4
DHS, 29.3
Other, 9.4
Office of Science Laboratories

Core Capabilities

* Particle Physics
* Nuclear Physics
* Accelerator Science and Technology
* Condensed Matter Physics and Materials Science
* Chemical and Molecular Science
* Applied Mathematics
* Advanced Computer Science, Visualization, and Data
* Applied Nuclear Science and Technology
* Applied Materials Science and Engineering
* Chemical Engineering
* Systems Engineering and Integration
* Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities

* Advanced Photon Source (APS)
* Argonne Leadership Computing Facility (ALCF)
* Center for Nanoscale Materials (CNM)
* Electron Microscopy Center (EMC)
* Argonne Tandem Linac Accelerator System (ATLAS)
* ARM Climate Research Facility

Office of Science (SC) Programs:

ASCR = Advanced Scientific Research Computing
BES = Basic Energy Sciences
BER = Biological and Environmental Research
FES = Fusion Energy Sciences
HEP = High Energy Physics
NP = Nuclear Physics
Office of Science Laboratories

Quick Facts

- Location: Upton, New York
- 5,320 acres and 302 buildings
- 2,989 Full Time Employees
- 399 Students
- 4,427 Facility Users
- 1,348 Visiting Scientists

FY14 Budget (enacted): $504M

FY 2012 Funding by Source (Costs in SM):

- BES, $280.7
- WFO, $55.8
- Other DOE, $7.0
- DHS, $4.6
- NNSA, $23.3
- EM, $17.4
- EERE, $6.8
- NP, $185.4

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NNSA = National Nuclear Security Administration
WFO = Work for Others
Core Capabilities
- Particle Physics
- Nuclear Physics
- Accelerator Science and Technology
- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Climate Change Science
- Biological Systems Science
- Applied Nuclear Science and Technology
- Applied Materials Science and Engineering
- Chemical Engineering
- Systems Engineering and Integration
- Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities
- National Synchrotron Light Source (NSLS)
- Relativistic Heavy Ion Collider (RHIC)
- Center for Functional Nanomaterials (CFN)
- ARM Climate Research Facility

Office of Science (SC) Programs:
- ASCR = Advanced Scientific Research Computing
- BES = Basic Energy Sciences
- BER = Biological and Environmental Research
- FES = Fusion Energy Sciences
- HEP = High Energy Physics
- NP = Nuclear Physics
Office of Science Laboratories

Quick Facts
- Location: Batavia, Illinois
- 6,800 acres and 362 buildings
- 1,757 Full Time Employees
- 4,300 Facility Users
- 32 Visiting Scientists

Core Capabilities
- Particle Physics
- Accelerator Science and Technology
- Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities
- Fermilab Accelerator Complex

FY14 Budget (enacted): $423M

FY 2012 Funding by Source (Costs in SM):
- ASCR, $0.6
- Other SC, $4.319
- WFO, $5.7
- DHS, $0.1
- HEP, $413.6

DHS = Department of Homeland Security
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NNSA = National Nuclear Security Administration
WFO = Work for Others

Office of Science (SC) Programs:
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- BES = Basic Energy Sciences
- BER = Biological and Environmental Research
- FES = Fusion Energy Sciences
- HEP = High Energy Physics
- NP = Nuclear Physics
Office of Science Laboratories

Quick Facts

- Location: Berkeley, California
- 202 acres (leased) and 97 buildings
- 3,395 Full Time Employees
- 493 Students
- 9,330 Facility Users
- 1,524 Visiting Scientists

FY14 Budget (enacted): $566M
Office of Science Laboratories

Core Capabilities
- Particle Physics
- Nuclear Physics
- Accelerator Science and Technology
- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Biological Systems Science
- Environmental Subsurface Science
- Climate Change Science
- Applied Mathematics
- Advanced Computer Science, Visualization, and Data
- Computational Science
- Applied Nuclear Science and Technology
- Applied Materials Science and Engineering
- Chemical Engineering
- Systems Engineering and Integration
- Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities
- Advanced Light Source (ALS)
- Molecular Foundry
- Joint Genome Institute (JGI)
- National Energy Research Computing Center (NERSC)
- Energy Sciences Network (ESnet)
- National Center for Electron Microscopy (NCEM)
- ARM Climate Research Facility

Office of Science (SC) Programs:
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- FES = Fusion Energy Sciences
- HEP = High Energy Physics
- NP = Nuclear Physics
Office of Science Laboratories

FY14 Budget (enacted): $1.05B

Quick Facts
- Location: Oak Ridge, Tennessee
- 4,421 acres and 196 buildings
- 4,368 Full Time Employees
- 520 Students
- 3,115 Facility Users
- 2,280 Visiting Scientists

FY 2012 Funding by Source (Costs in SM):

- ASCR, 99.5
- DHS, 39.6
- NNSA, 233.4
- EERE, 170.4
- FES, 151
- EEC, 120
- BES, 319.8
- NE, 88.4
- EM, 17.7
- NP, 29.6
- Other, 40
- WFO, 250
- BER, 77.8
- Other DOE, 27.3

DHS = Department of Homeland Security
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EM = DOE Office of Environmental Management
NE = DOE Office of Nuclear Energy
NNSA = National Nuclear Security Administration
WFO = Work for Others
Office of Science Laboratories

Core Capabilities
- Nuclear Physics
- Accelerator Science and Technology
- Plasma and Fusion Energy Sciences
- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Climate Change Science
- Biological Systems Science
- Environmental Subsurface Science
- Advanced Computer Science, Visualization, and Data
- Computational Science
- Applied Nuclear Science and Technology
- Applied Materials Science and Engineering
- Chemical Engineering
- Systems Engineering and Integration
- Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities
- Spallation Neutron Source (SNS)
- High Flux Isotope Reactor (HFIR)
- Oak Ridge Leadership Computing Facility (OLCF)
- Center for Nanophase Materials Sciences (CNMS)
- Shared Research Equipment User Facility (Share)
- ARM Climate Research Facility

Office of Science (SC) Programs:
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BES = Basic Energy Sciences
BER = Biological and Environmental Research
FES = Fusion Energy Sciences
HEP = High Energy Physics
NP = Nuclear Physics
Office of Science Laboratories

FY14 Budget (enacted): $566M

Quick Facts
- Location: Richland, Washington
- 670 acres and 95 buildings
- 3,922 Full Time Employees
- 366 Students
- 2,400 Facility Users
- 49 Visiting Scientists

FY 2012 Funding by Source (Costs in $M):
- ASCR, $6.2
- BES, $27.4
- BER, $122.8
- WFO, $187.5
- DOE Energy, $94.7
- DOE, $48.3
- DHS, $63.3
- Other SC, $15.6
- NNSA, $287.7
- EM, $5.7

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EM = DOE Office of Environmental Management
NE = DOE Office of Nuclear Energy
NNSA = National Nuclear Security Administration
WFO = Work for Others
Office of Science Laboratories

Core Capabilities

- Chemical and Molecular Science
- Climate Change Science
- Biological Systems Science
- Environmental Subsurface Science
- Advanced Computer Science, Visualization, and Data Science
- Applied Nuclear Science and Technology
- Applied Materials Science and Engineering
- Chemical Engineering
- Systems Engineering and Integration
- Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities

- Environmental Molecular Sciences Laboratory (EMSL)
- ARM Climate Research Facility

Office of Science (SC) Programs:

ASCR = Advanced Scientific Research Computing
BES = Basic Energy Sciences
BER = Biological and Environmental Research
FES = Fusion Energy Sciences
HEP = High Energy Physics
NP = Nuclear Physics
Office of Science Laboratories

FY14 Budget (enacted): $77M

Quick Facts
- Location: Princeton, New Jersey
- 88.5 acres and 34 buildings
- 414 Full Time Employees
- 40 Students
- 300 Visiting Scientists

Core Capabilities
- Plasma and Fusion Energy Sciences
- Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities
- National Spherical Torus Experiment (NSTX)
Office of Science Laboratories

FY14 Budget (enacted): $398M

Quick Facts
- Location: Menlo Park, California
- 426 acres and 151 buildings
- 1,684 Full Time Employees
- 124 Students
- 3,411 Facility Users
- 31 Visiting Scientists

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EM = DOE Office of Environmental Management
NE = DOE Office of Nuclear Energy
NNSA = National Nuclear Security Administration
WFO = Work for Others
Office of Science Laboratories

Core Capabilities

- Particle Physics
- Accelerator Science and Technology
- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities

- Stanford Synchrotron Radiation Lightsource (SSRL)
- Linac Coherent Light Source (LCLS)
- Facility for Advanced Accelerator Experimental Tests (FACET)

Office of Science (SC) Programs:

ASCR = Advanced Scientific Research Computing
BES = Basic Energy Sciences
BER = Biological and Environmental Research
FES = Fusion Energy Sciences
HEP = High Energy Physics
NP = Nuclear Physics
Office of Science Laboratories

FY14 Budget (enacted): $163M

Quick Facts
- Location: Newport News, Virginia
- 169 acres and 83 buildings and trailers
- 759 Full Time Employees
- 43 Students
- 1,385 Facility Users

DHS = Department of Homeland Security
EERE = DOE Office of Energy Efficiency and Renewable Energy
EM = DOE Office of Environmental Management
NE = DOE Office of Nuclear Energy
NNSA = National Nuclear Security Administration
WFO = Work for Others
Office of Science Laboratories

Core Capabilities

- Nuclear Physics
- Accelerator Science and Technology
- Applied Nuclear Science and Technology
- Large Scale User Facilities / Advanced Instrumentation

Office of Science User Facilities

- Continuous Electron Beam Accelerator Facility (CEBAF)

Office of Science (SC) Programs:

ASCR = Advanced Scientific Research Computing
BES = Basic Energy Sciences
BER = Biological and Environmental Research
FES = Fusion Energy Sciences
HEP = High Energy Physics
NP = Nuclear Physics
Lawrence Livermore ($1.1B)
 Responsible for the safety and reliability of the nuclear explosives package in nuclear weapons; supports surveillance, assessment, and refurbishment of the nuclear weapons stockpile.

Los Alamos ($1.9B)
 Responsible for the safety and reliability of the nuclear explosives package in nuclear weapons; possesses unique capabilities in neutron scattering, enhanced surveillance, radiography, and plutonium science and engineering.

Sandia Laboratories ($1.7B)
 Responsible for the development, testing, and production of specialized nonnuclear components and quality assurance and systems engineering for all US nuclear weapons.
Other National Laboratories

SAVANNAH RIVER ($15.9M)
Office of Environmental Management
Creates, tests and deploys solutions the technological challenges in three key areas: national and homeland security, energy security, and environmental management.

NATIONAL RENEWABLE ENERGY LABORATORY ($270M)
Office of Energy Efficiency and Renewable Energy
Renewable energy/energy efficiency research and development; advances related science and engineering, and transfers knowledge and innovations to address nation's energy/environmental goals.

IDAHO NATIONAL LABORATORY ($1.07B)
Office of Nuclear Energy, Science and Technology
Science-based applied engineering supporting nuclear and energy research, science, and national defense.
Other National Laboratories

NATIONAL ENERGY TECHNOLOGY LABORATORY ($731M)
Offices of Fossil Energy, Energy Efficiency & Renewable Energy, and Electricity Delivery & Energy Reliability
Implements energy and environmental research and development programs, including those related to domestic coal, natural gas, and oil to power homes, industries, businesses, and transportation.
National Nuclear Security Administration
Lab/Facility Links