U.S. DEPARTMENT OF ENERGY | Office of Science

News from the Office of Science

Nuclear Sciences Advisory Committee

July 27, 2009

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U.S. Department of Energy

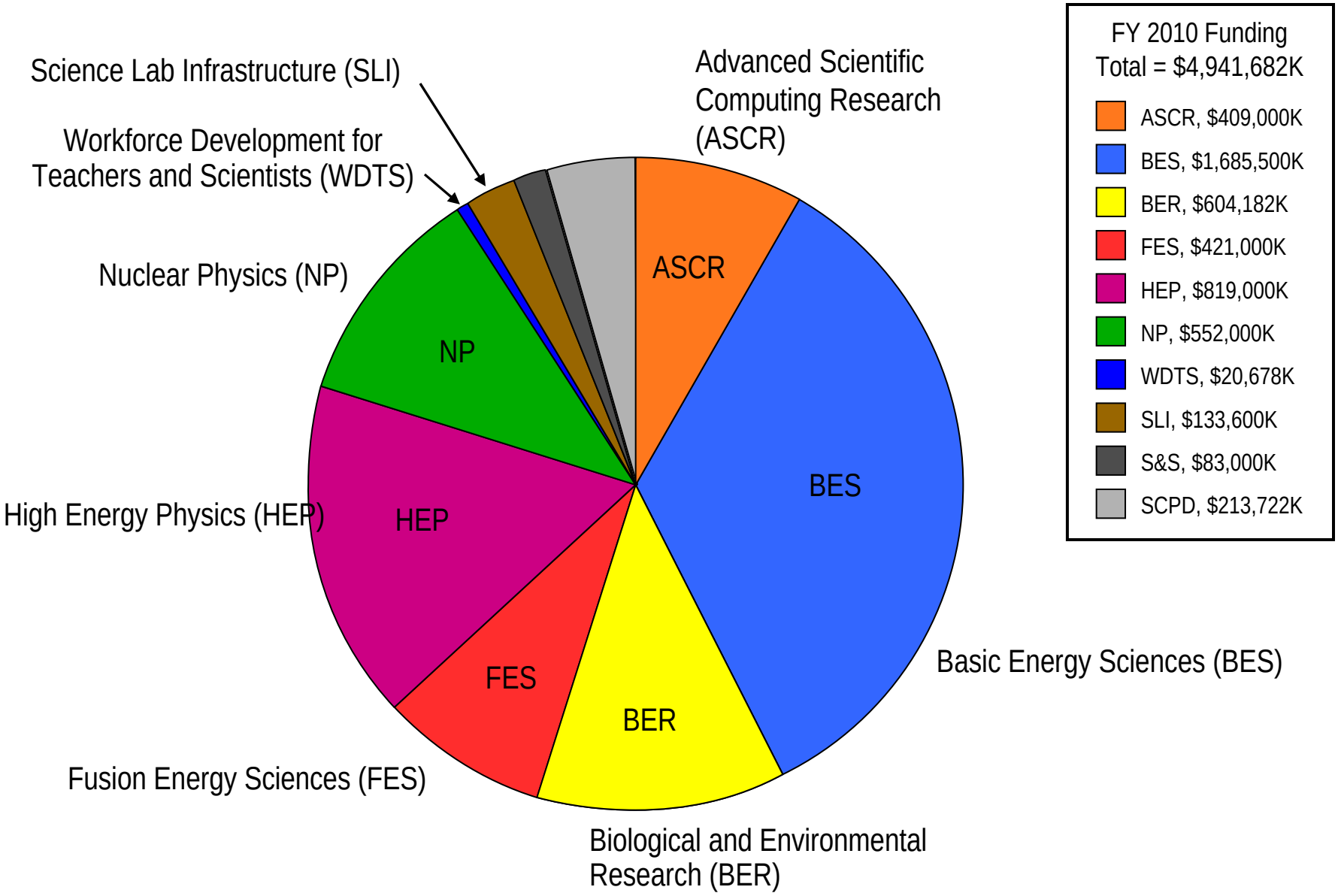
DOE's Office of Science

The Office of Science is one of the nation's largest supporters of peer-reviewed basic research, providing 40% of Federal support in the physical sciences and supporting ~25,000 Ph.D.s, graduate students, undergraduates, engineers, and support staff at more than 300 universities and at all 17 DOE laboratories.

Three themes describe the work supported by the Office of Science:

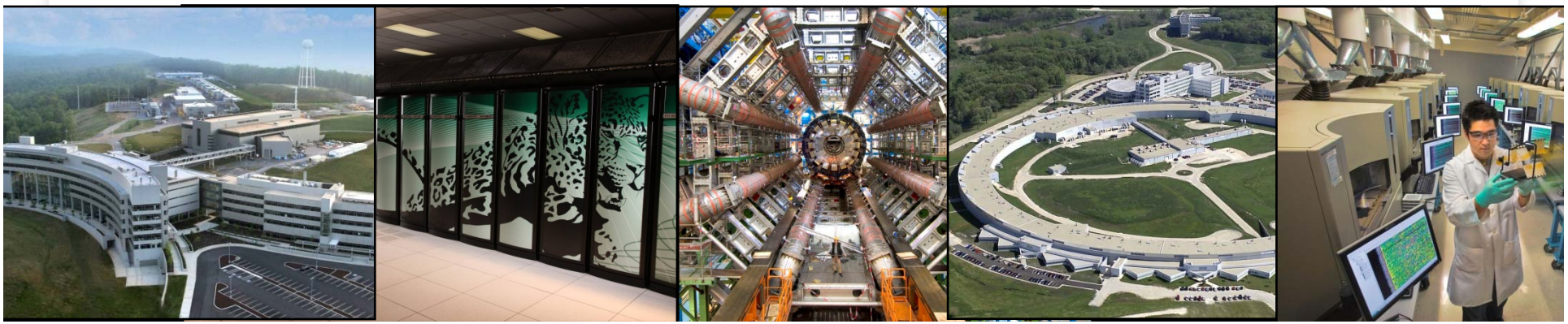
- **Science for discovery**
  - Unraveling Nature's deepest mysteries—from the study of subatomic particles; to atoms and molecules that make up the materials of our everyday world; to DNA, proteins, cells, and entire natural ecosystems
- **Science for national need**
  - Advancing a clean energy agenda through basic research on energy production, storage, transmission, and use
  - Advancing our understanding of the Earth's climate through basic research in atmospheric and environmental sciences and in climate modeling
  - Supporting DOE's missions in national security
- **National scientific user facilities, the 21st century tools of science**
  - Providing the Nation's researchers with the most advanced tools of modern science including accelerators, colliders, supercomputers, light sources and neutron sources, and facilities for studying the nanoworld, the environment, and the atmosphere

Office of Science Programs



User Facilities

- Advanced **computational resources** – terascale to petascale computing and networks for open science
- Four **synchrotron light sources**, and two next-generation light sources in construction
- Three **neutron sources** for scattering
- **Particle accelerators/colliders/detectors** for high energy and nuclear physics
- **Fusion/plasma facilities**, including **ITER** which seeks to demonstrate a burning plasma
- Five **Nanoscale Science Research Centers** – capabilities for fabrication and characterization of materials at the nanoscale
- **Joint Genome Institute** for rapid whole genome sequencing
- **Environmental Molecular Science Laboratory** – experimental and computational resources for environmental molecular sciences
- **Atmospheric and Environmental Facilities** – capabilities for cloud and aerosol measurement and for carbon cycling measurements



Distribution of Users by Facility

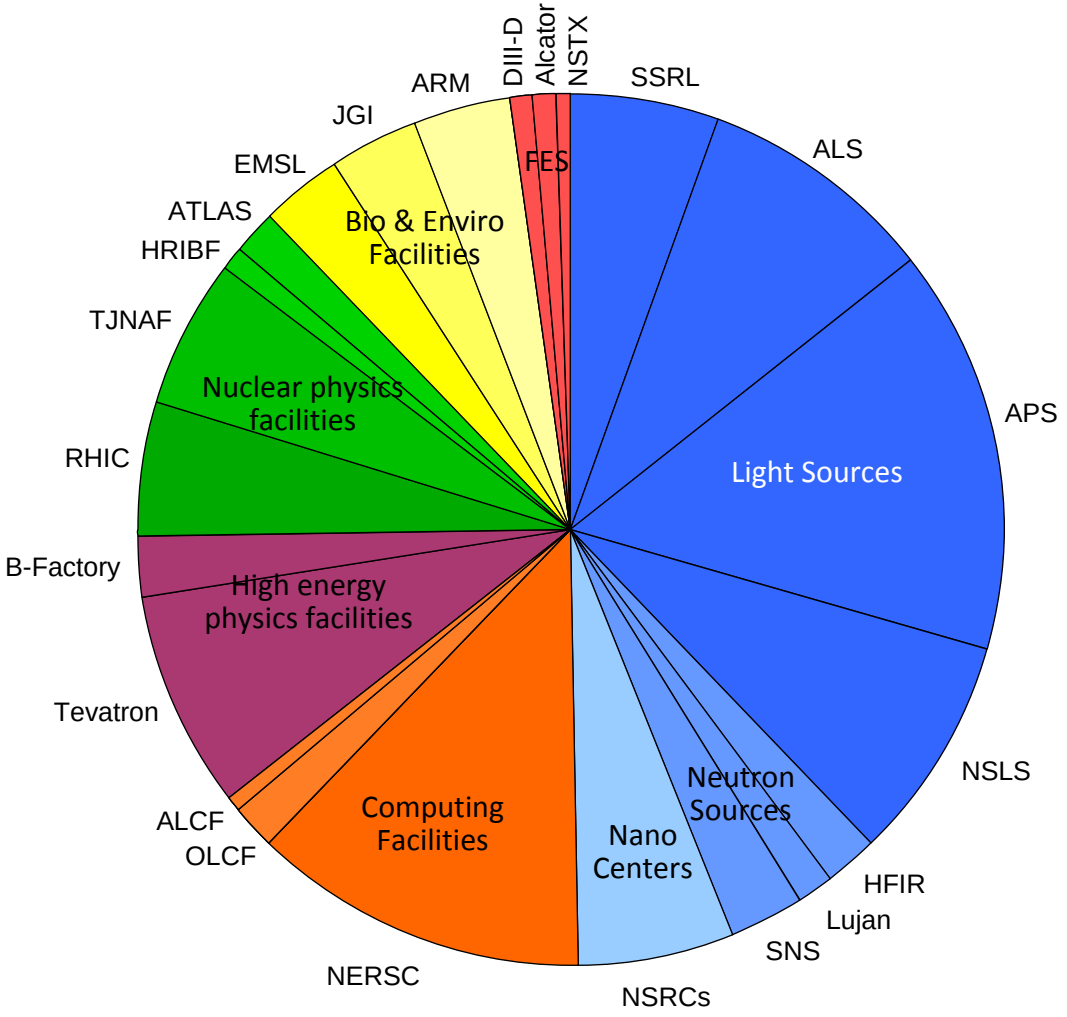
~25,000 users at the facilities in FY 2010:

~1/2 from universities;

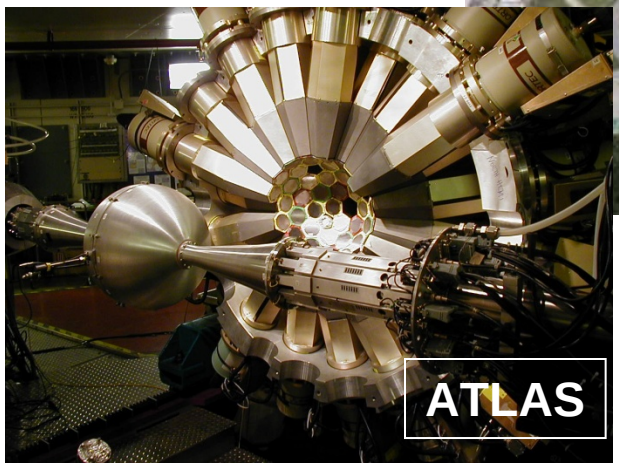
~1/3 from national labs;

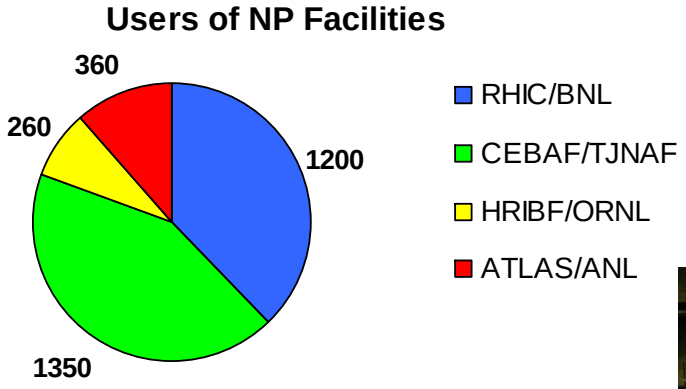
and the remainder from industry, other agencies, and international entities.

Breakdown by facility of ~25,000 users in FY 2010



Providing Nuclear Beams for the Research Community





- **Approximately 40% of users are from foreign institutions**
- **Users include DOE, NSF, NNSA, NASA, DOD, and industry**

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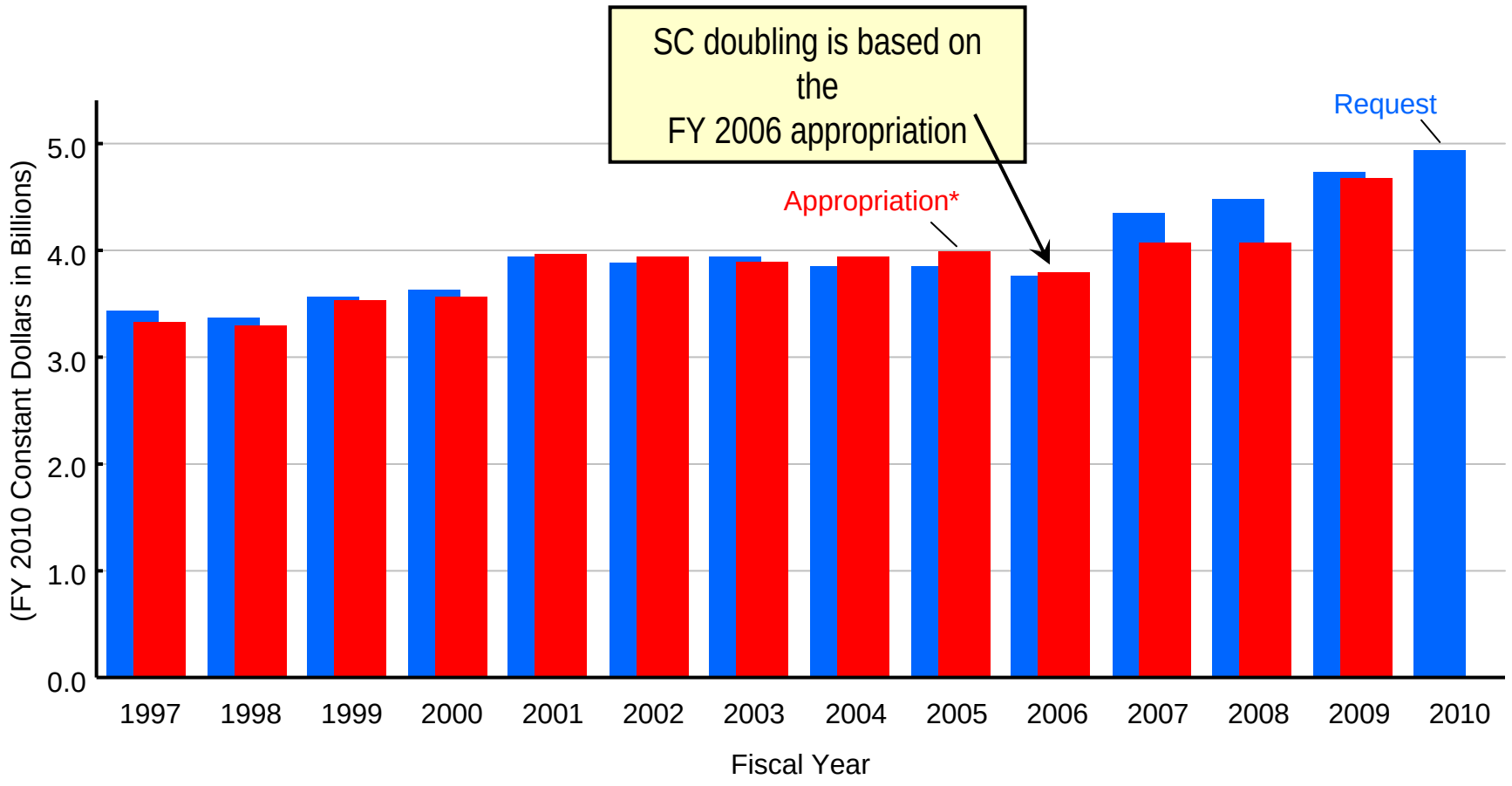
SC Request vs. Appropriation (FY 2010 Constant $s)



* Appropriation amounts exclude Congressionally directed projects.

Training the Next Generation of Scientists and Engineers

The Department of Energy has >50 year history of training scientists, mathematicians, and engineers through research grants, the DOE national laboratories, and targeted education programs.

- In FY 2008, more than 300,000 K-12 students; 21,000 educators; 3,000 graduate students; and 4,200 undergraduate students participated in opportunities at the DOE labs, funded by DOE and other federal and non-federal sources.
- SC will support over 4,400 graduate students and 2,700 post docs in FY 2009.
- In FY 2009, the Office of Workforce Development for Teachers and Scientists will support ~550 undergraduates in research internships at the DOE laboratories (and 1,175 in FY 2010 request) and ~280 K-16 educators.
- The DOE National Science Bowl attracts ~22,000 high school and middle school students every year.
- With Recovery Act funds and the FY 2010 request, SC initiated the DOE SC Graduate Fellowship Program, supporting over 160 graduate students in fields important to SC missions.
- SC proposes to increase the Graduate Fellowship Program to support approximately 400 graduate students in the out-years.

Early Career Research Program

The Department of Energy is now accepting proposals for the DOE Office of Science Early Career Research Program to support the research of outstanding scientists early in their careers.

Purpose: To support the development of individual research programs of outstanding scientists early in their careers and to stimulate research careers in the disciplines supported by the Office of Science.

- Letters of Intent due August 3, 2009.
- Full proposals due September 1, 2009.
- See the announcements for details on eligibility and program rules

http://www.science.doe.gov/SC-2/early_career.htm

Status of FY 2010 Appropriations

Office of Science
FY 2010 Appropriations Status
(dollars in thousands)

	FY 2009		FY 2010		
	Enacted Approp.	Recovery Act Approp.	Request to Congress	House Passed	Senate Mark
Office of Science					
Basic Energy Sciences	1,571,972	555,406	1,685,500	1,675,000	1,653,500
Advanced Scientific Computing Research	368,820	161,795	409,000	409,000	399,000
Biological & Environmental Research	601,540	165,653	604,182	597,182	604,182
High Energy Physics	795,726	232,390	819,000	819,000	813,000
Nuclear Physics	512,080	154,800	552,000	536,455	540,000
Fusion Energy Sciences	402,550	91,023	421,000	441,000	416,000
Science Laboratories Infrastructure	145,380	198,114	133,600	133,600	133,600
Science Program Direction	186,695	5,600	213,722	190,932	194,722
Workforce Development for Teachers & Scientists	13,583	12,500	20,678	20,678	20,678
Safeguards & Security	80,603	——	83,000	83,000	83,000
Small Business Innovation Research/Tech. Transfer	——	18,719	——	——	——
Subtotal, Science	4,678,949	1,596,000	4,941,682	4,905,847	4,857,682
Advanced Research Projects Agency-Energy	15,000	——	——	——	——
Congressionally-directed projects	93,687	——	——	37,740	41,150
Subtotal, Science	4,787,636	1,596,000	4,941,682	4,943,587	4,898,832
Use of prior year balances	-15,000	——	——	——	——
Less Advanced Research Projects Agency-Energy	-15,000	——	——	——	——
Total, Office of Science	4,757,636	1,596,000 [1/]	4,941,682	4,943,587	4,898,832

[1/] $4,000 has been transferred to Departmental Administration for management and oversight.

DOE Energy Innovation Hubs

Proposed topics for Hubs:

- **Solar Electricity (EERE)**
- **Fuels from Sunlight (SC)**
- **Batteries and Energy Storage (SC)**
- **Carbon Capture and Storage (FE)**
- **Electrical Grid Systems (OE)**
- **Energy Efficient Building Systems Design (EERE)**
- **Extreme Materials for Nuclear Fuel Cycles and Systems (NE)**
- **Modeling and Simulation for Nuclear Fuel Cycles and Systems (NE)**

Each Hub will comprise a world-class, multi-disciplinary and highly collaborative research and development team working largely under one roof. This team will focus on solving critical technology challenges that prevent large scale commercialization and deployment of the energy systems needed to address our Nation's greenhouse gas emission, energy security and workforce creation goals

Status of SC Recovery Act Projects

The goals of the Recovery Act are articulated in the Act's "Statement of Purpose." Two that were key to our decisions are:

- "(1) To **preserve and create jobs** and promote economic recovery"; and
- "(3) To provide investments needed to increase economic efficiency by **spurring technological advances in science** and health."

SC ARRA projects were selected having specific characteristics:

- Shovel-ready
- Enhance research infrastructure and support high-priority R&D
- Low risk (e.g., construction projects were baselined with in-place or imminent CD-3; research projects had proposals in hand or solicitations were to be fast)
- No out-year mortgages, with two exceptions (EFRCs and Graduate Fellowship/Early Career Awards)

Status of SC Recovery Act Projects

51 projects totaling $1.6B

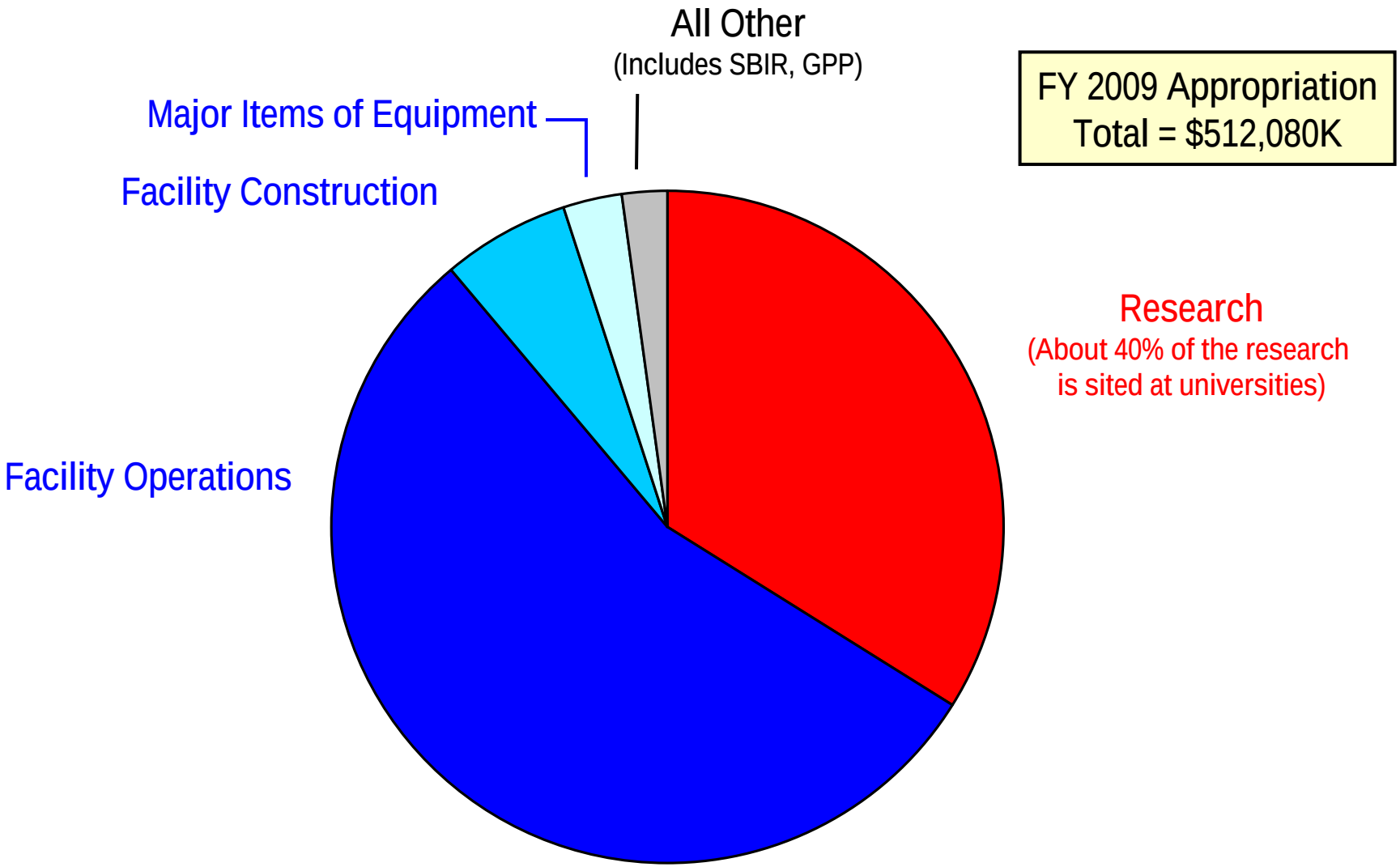
- **Acceleration of Ongoing Line-Item Construction Projects - $338.2M**
  - NSLS-II ($150.0M)
  - TJNAF 12 GeV upgrade ($65.0M)
  - Science Laboratory Infrastructure (SLI) Construction ($108.5M)
- **Acceleration of Major Items of Equipment - $171.1M**
  - NOvA MIE ($55.0M)
- **Upgrades to SC User Facilities - $391.0M**
  - Advanced Networking ($66.8M)
  - Atmospheric Radiation Measurement (ARM) Climate Research Facility ($60.0M)
  - Environmental Molecular Sciences Laboratory ($60.0M)
  - Light Source Instrumentation/Enhancements ($24.0M)
  - Nanoscale Science Research Center Instrumentation ($25.0M)
- **Laboratory General Plant Projects - $129.6M**
- **Scientific Research - $562.1M**
  - Energy Frontier Research Centers ($277.0M; forward-funded 5 years)
  - Energy Sciences Fellowships and Early Career Awards – ($97.5M; forward-funded 3-5 years)
- **Management and Oversight - $8.0M**

Status of NP Recovery Act Projects

	Amount
12 GeV CEBAF Upgrade	65,000
Nuclear Science Workforce	19,440
Lattice Quantum Chromodynamics Computing	4,965
Nuclear Data Program Initiative	1,944
Fundamental Neutron Physics Beamline MIE at SNS	600
PHENIX Silicon Vertex MIE at RHIC	250
PHENIX Forward Vertex Detector MIE at RHIC	2,000
TJNAF Infrastructure Investments	10,000
Enhanced AIP at NP User Facilities	25,000
Enhanced Utilization of Isotope Facilities	10,000
R&D on Alternative Isotope Production Techniques	4,617
Total NP	**143,816**

(dollars in thousands)

NP Support by Major Function



New NSAC Charge

To assemble a Committee of Visitors (COV) to review the management processes of the Office of Nuclear physics program.

The panel should:

1. Provide an assessment of the processes used to solicit, review, recommend, and document proposal actions and monitor projects and programs for both DOE laboratory and university programs.
2. Assess the operations of the Office's programs during the FY 2007, FY 2008, and FY 2009
3. Consider and provide evaluation of the following major elements:
   - the efficacy and quality of the processes
   - the quality of the resulting portfolio, including breadth and depth, and its national and international standing.

The panel should also comment on:

- Observed strengths or deficiencies in any component or sub-component of the Office's portfolio and suggestions for improvement.
- Progress made towards addressing action items from the previous COV review.

Report should be submitted to NSAC by February 28, 2010.

NP Strategic Directions- 2010 & Beyond

Science for Discovery – Discovering, exploring and understanding all forms of nuclear matter

- Three strategic themes:
  - Develop a complete understanding of how quarks and gluons assemble themselves in the various forms of nuclear matter and search for as yet undiscovered forms of matter
  - Understand how protons and neutrons combine to form atomic nuclei and how the atomic nuclei have arisen since the birth of the cosmos
  - Develop a better understanding of the fundamental properties of the neutron and the neutrino, and their impact on the Standard Model of fundamental particle and interactions

National Scientific User Facilities – the 21st century tools of science

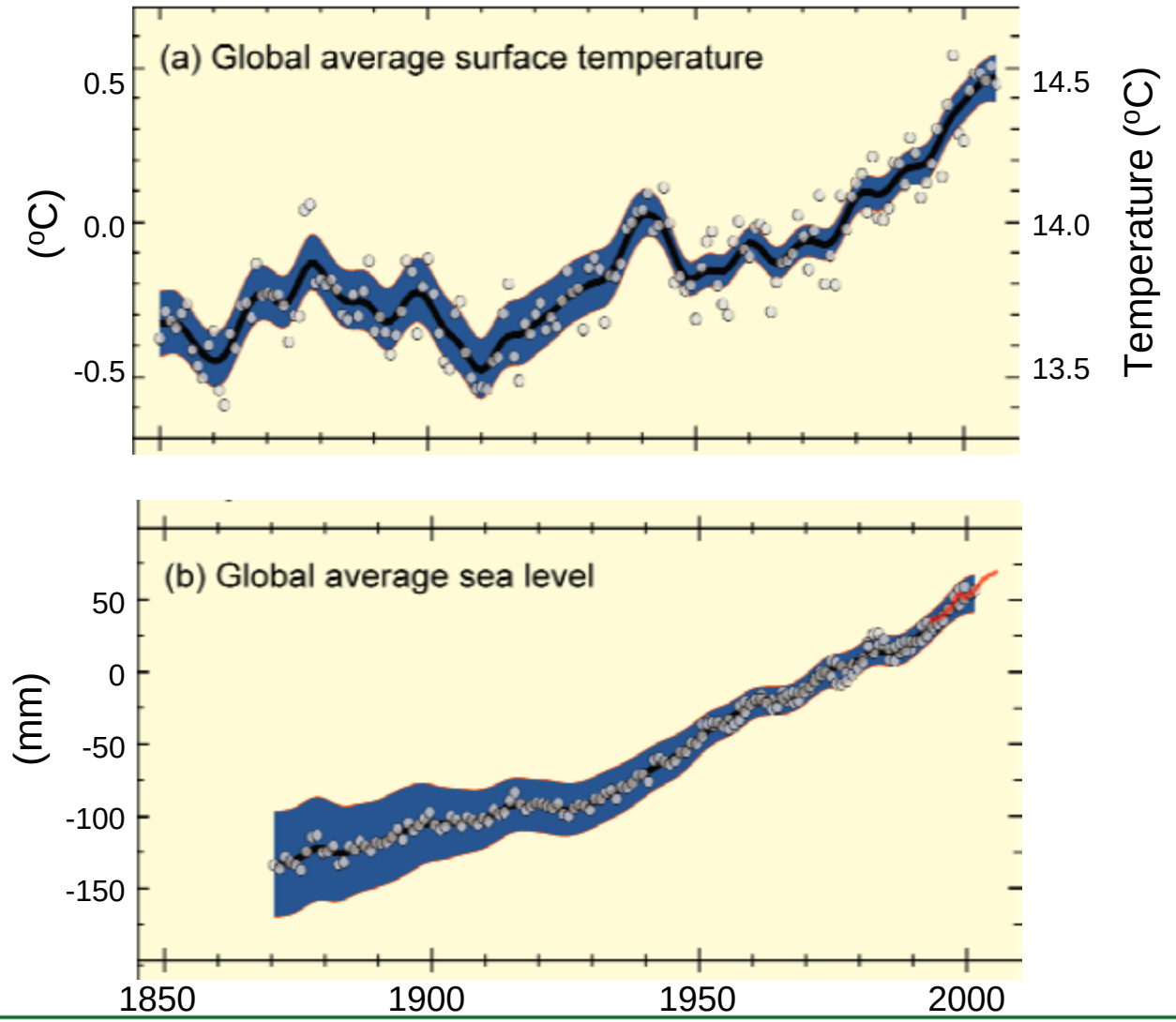
- Complete the 12 GeV Continuous Electron Beam Facility Upgrade
- Construct the Facility for Rare Isotope Beams at Michigan State University
- Continue a targeted program of experiments to investigate neutrino properties and fundamental symmetries
- Implement a luminosity upgrade at the Relativistic Heavy Ion Collider
- Conduct R&D to lay the foundation for a possible electron-ion collider
- Ensure operational excellence and scientific impact of the program's accelerator and large detector facilities
- Effective production of radioisotopes to serve the Nation's needs

NP Strategic Directions- 2010 & Beyond

Science for National Need – Bringing forefront scientific knowledge and state-of-the-art tools to serve the nation

- Nuclear Science is inherent to a broad suite of applications such as nuclear power, waste disposal, nuclear medicine, commerce, medical physics, space exploration, finance, geology, environmental sciences, national security, and others
- Applications of Nuclear Science and Technology: new initiative supported in FY 2009. Nuclear science research important to NP mission which is relevant to applications.
- Advances in state-of-the art accelerator systems
- Development of advanced instrumentation, detector components and systems
- Reliable, timely, and economical delivery of stable and radioactive isotopes for commercial application and research
- Evaluated nuclear data for applied technologies and basic research
- Training the next generation of nuclear scientists, many of which enter applied fields

Recent Climate Trends



Annual Greenhouse Gas Contributions