U.S. Department of Energy

Office of Science

Transformational Science for Energy, Environment, and America's Competitiveness

FY 2008 Budget Request
for the Office of Science

Dr. Raymond L. Orbach
Under Secretary for Science

February 5, 2007
www.science.doe.gov

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The President's FY 2008 Request will enable scientific discoveries essential to solving our Nation's challenges

"It's in our vital interest to diversify America's energy supply – **the way forward is through technology**…

"America is on the verge of technological breakthroughs that will enable us to live our lives less dependent on oil. **And these technologies will help us be better stewards of the environment, and they will help us to confront the serious challenge of global climate change.**"

President George W. Bush
State of the Union Address
January 23, 2007

"**We must commit to doubling federal funding for basic research and development in the physical sciences….**"

Speaker Nancy Pelosi
U.S. House of Representatives
January 19, 2007

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The FY 2008 President's Budget Request for the Office of Science is an investment in America's future

*The FY 2008 budget enables the Office of Science to deliver on its mission and **enhance U.S. competitiveness** through…*

Transformational Science

Basic research for advanced scientific breakthroughs that will revolutionize our approach to the Nation's energy, environment, and national security challenges

National Scientific Facilities

World-leading research capabilities that maintain U.S. leadership in science and technological innovation

A Scientific Workforce for the Nation's Future

Supporting, training, and educating the Nation's current and future scientific & technical workforce: Ph.D.'s, post-docs, graduate students, and science educators

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FY 2008 Congressional Budget Request

(B/A in thousands)

	FY 2005 Approp.	FY 2006 Approp.	FY 2007 Request to Congress	FY 2007 vs. † FY 2006		FY 2008 Request to Congress	FY 2008 vs. FY 2007	
Basic Energy Sciences	1,083,616	1,110,148	1,420,980	+310,832	+28.0%	1,498,497	+77,517	+5.5%
Advanced Scientific Computing Research	226,180	228,382	318,654	+90,272	+39.5%	340,198	+21,544	+6.8%
Biological & Environmental Research								
BER Base Program	487,474	435,476	510,263	+74,787	+17.2%	531,897	+21,634	+4.2%
Congressionally-directed projects	79,123	128,601	——	-128,601	-100.0%	——	——	——
Total, Biological & Environmental Research	566,597	564,077	510,263	-53,814	-9.5%	531,897	+21,634	+4.2%
High Energy Physics	722,906	698,238	775,099	+76,861	+11.0% ††	782,238	+7,139	+0.9% ††
Nuclear Physics	394,549	357,756	454,060	+96,304	+26.9%	471,319	+17,259	+3.8%
Fusion Energy Sciences	266,947	280,683	318,950	+38,267	+13.6%	427,850	+108,900	+34.1%
Science Laboratories Infrastructure	37,498	41,684	50,888	+9,204	+22.1%	78,956	+28,068	+55.2%
Science Program Direction	154,031	159,118	170,877	+11,759	+7.4%	184,934	+14,057	+8.2%
Workforce Development for Teachers & Scientists	7,599	7,120	10,952	+3,832	+53.8%	11,000	+48	+0.4%
S&S	67,168	68,025	70,987	+2,962	+4.4%	70,987	——	——
Use of prior year balances	-5,062	——	——	——	——	——	——	——
SBIR/STTR (from SC programs)	77,842	81,160	——	-81,160	-100.0%	——	——	——
Subtotal, Science	3,599,871	3,596,391	4,101,710	+505,319	+14.1%	4,397,876	+296,166	+7.2%
SBIR/STTR (transferred from other DOE programs)	35,779	35,653	——	-35,653	-100.0%	——	——	——
Total, Science	3,635,650	3,632,044	4,101,710	+469,666	+12.9%	4,397,876	+296,166	+7.2%

† The FY 2008 President's Budget Request and the material presented here assume the requested level for FY 2007, as the timing of FY 2007 appropriations did not allow their inclusion.

†† A portion of Stanford Linear Acceleration Center linac operations transfers from High Energy Physics to Basic Energy Sciences in FY 2007 and FY 2008. Excluding the linac operations funding, the remainder of the High Energy Physics budget increases by 12.6% in the FY 2007 request and a further 3.7% in FY 2008.

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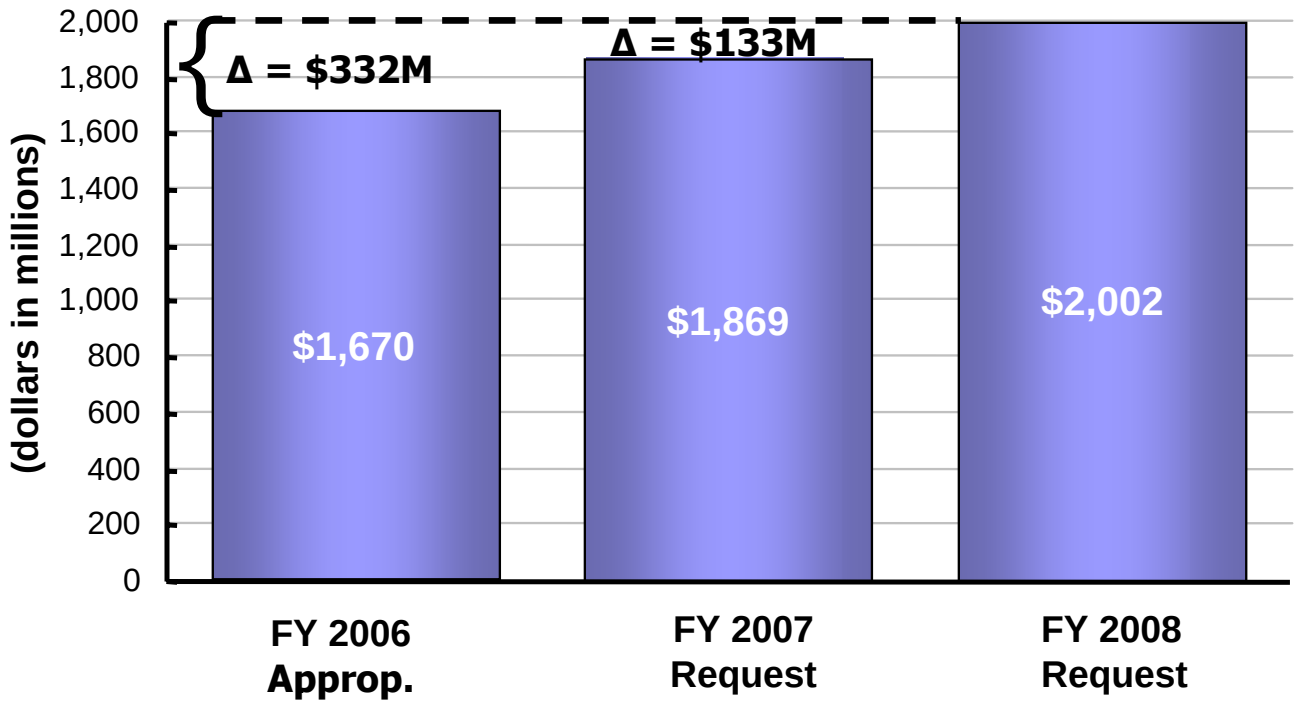
The President's FY 2008 request supports transformational research for enhanced **U.S. competitiveness**

Office of Science Core Research Funding*—a 7.1% increase over the FY 2007 Request



The FY 2008 request is a 19.8% increase over the FY 2006 appropriated level.

* Excludes facility operations, capital projects, and supporting programs such as program direction

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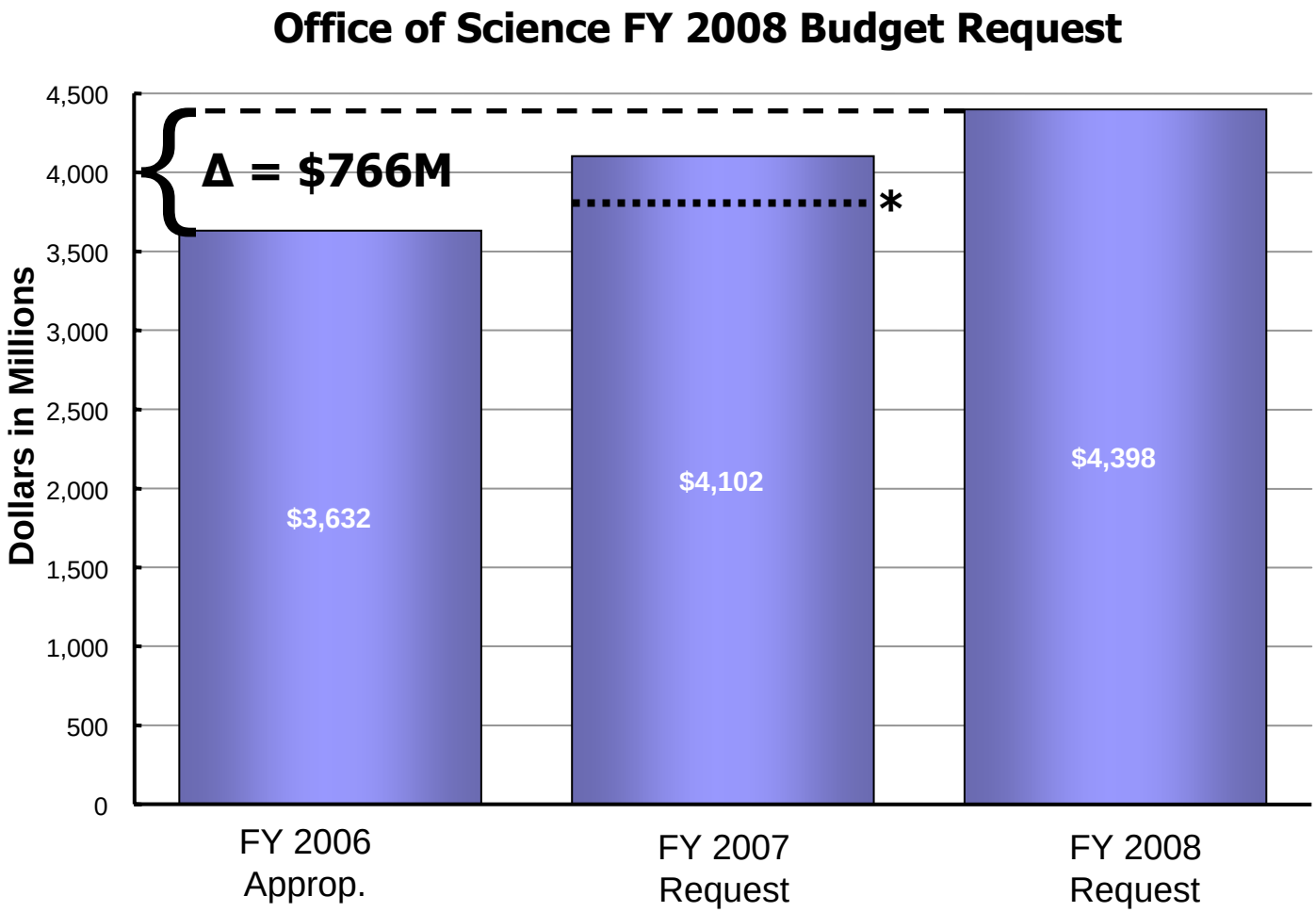
The President's FY2008 request supports transformational research for enhanced **U.S. competitiveness**



*** On January 31, 2007, the U.S. House of Representatives passed an appropriations level of $3,796 million for FY 2007.**

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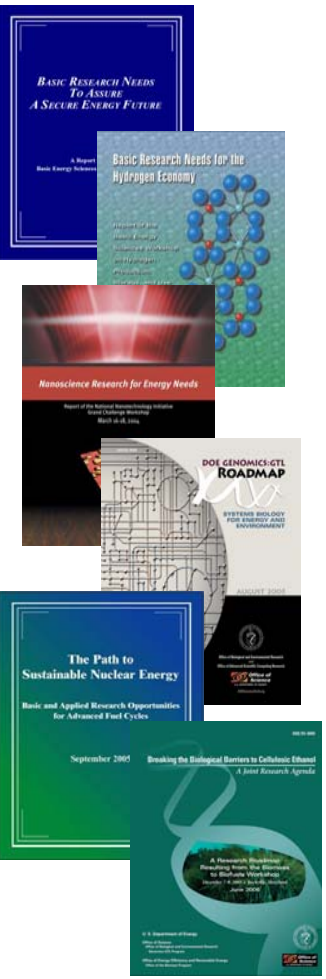
Workshops help identify scientific research opportunities for future investment in support mission need and national initiatives



Basic Research Needs to Assure a Secure Energy Future

BES Workshop, October 21-25, 2002

The foundational workshop that set the model for focused workshops that follow

Workshops	Research Supported	Initiative
Basic Research Needs for the Hydrogen Economy **BES Workshop, May 13-15, 2003**	**Hydrogen (BES, BER)** FY06=$45.0M; FY07=$70.0M; FY08=$74.5M	Hydrogen Initiative/ Advanced Energy Initiative
Nanoscience Research for Energy Needs **BES and the National Nanotechnology Initiative, March 16-18, 2004**	**Nanoscience (BES, ASCR, BER)** FY06=$204.9M; FY07=$256.9M; FY08=$285.6M	Nanotechnology Initiative/ Competitiveness
Breaking the Biological Barriers to Cellulosic Ethanol, BER and EERE, December 7-9, 2005	**Biomass/Biofuels (BER, BES)** FY06=$22.9M; FY07=$62.5M; FY08=$112.9M	Advanced Energy Initiative/ DOE Mission Need

Recent & Future Workshops:

DOE Cybersecurity R&D Challenges for Open Science, **ASCR January 24-26, 2007**

Basic Research Needs for Electrical Energy Storage, **BES April 2-5, 2007**

Systematic Errors in Climate and Numerical Weather Prediction, **DOE/BER/LLNL partnership with the international World Climate Research Programme, February 12-14, 2007**

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Research capabilities and tools to drive U.S. competitiveness

Advanced systems biology research on microbes and plants – driving scientific breakthroughs necessary for the development of cost-effective methods for biofuels and bioenergy production.

- **Three Bioenergy Research Centers** are supported in FY 2008 ($75.0M)

Next generation tools – for assembly and characterization of matter and materials enabling transformational science for energy applications and U.S. competitiveness.

- **National Synchrotron Light Source-II (NSLS-II)** – a light source facility with the world's finest capabilities for x-ray imaging, capable of nanometer resolution – continued support for R&D and project engineering and design (PED) ($65.0M)
- **Linac Coherent Light Source (LCLS)** – an x-ray free electron laser that will allow examinations of chemical reactions in real time at the single molecule level – construction and instrumentation development continues ($76.9M)
- **Spallation Neutron Source (SNS)** – the world's forefront neutron scattering facility, by an order of magnitude was completed and began operations in 2006 – full operations continue & additional experimental capabilities continue to be added ($188.6M)

Providing unmatched capabilities for research at the nanoscale –

- **DOE Nanoscience Research Centers** – all 5 nanoscience centers will be operating in FY 2008 ($100.5M)

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World-leading research and resources for U.S. science

Advanced computational science – extending the frontiers of science.

- **National Energy Research Scientific Computing Center (NERSC)** – continues to provide cutting-edge supercomputing resources at 100-150 teraflop capacity ($54.8M)
- **Leadership Computing** – on the road to petascale capabilities, the ORNL Leadership Computing Facility (LCF) will reach 1 petaflop computing capability by the end of FY 2008 ($77.0M); the ANL LFC IBM Blue Gene P will provide between 250-500 teraflops ($28.0M)

Theoretical and experimental high energy physics – studying the elementary constituents of matter and energy and interactions at the heart of physics to understand how our universe works at its most fundamental level.

- **Tevatron / Large Hadron Collider / B-Factory** – continuing to reach milestones in the search to understand the fundamental forces of nature – full operations of the Tevatron, the world's most powerful particle collider and B-factory ($334.0M)
  - **Neutrino Physics** – full operation of the neutrino oscillation experiment and start of fabrication of a next generation detector to provide a platform for a world-leading neutrino program in the U.S.
- **Accelerator R&D** – ILC R&D ($60M) and superconducting radiofrequency (RF) technology R&D ($23.5M) – to enable the most compelling science opportunities in the coming decade

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Powerful tools and capabilities will accelerate U.S. scientific discovery and innovation

Fusion science and an international fusion experiment – to demonstrate the scientific and technological feasibility of fusion power.

- **ITER** – U.S. procurement, fabrication, and delivery of medium- and high-technology components and U.S. share of the common costs at the ITER site are supported ($160.0M)

Supporting fundamental research on understanding of nuclear matter – advancing our knowledge on the nature of matter and energy; maintaining U.S. leadership in nuclear physics research central to the development of technologies for nuclear energy, nuclear medicine, and national security.

- **Continuous Electron Beam Accelerator Facility (CEBAF) Upgrade** – maintains status as the world's most powerful "microscope" for studying the quark structure of matter – R&D and project engineering and design (PED) for an upgrade to double beam energy supported ($14.5M)
- **Relativistic Heavy Ion Collider (RHIC)** – continuing studies of the internal quark-gluon structure of nucleons and the properties of hot, dense nuclear matter ($162.2M)
- **Rare Isotope Beams** – continuing R&D to develop advanced rare isotope beam capabilities and initiating a solicitation for design of a next generation U.S. facility for nuclear structure and astrophysics – R&D ($4.0M)

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Science for environmental solutions & investment in our Nation's scientific talent

Science and technology solutions to long-term environmental challenges –

- **Climate Change Science Research** - understanding the principal uncertainties of the causes and effects of climate change, including abrupt climate change, understanding the global carbon cycle and supporting basic research for biological sequestration of carbon ($129.6M)
- **Geosciences** – basic research underpinning the Nation's strategy for understanding and mitigating terrestrial impacts of energy technologies - understanding subsurface chemistry; new approaches to understanding subsurface physical properties of fluids, rocks and minerals, and how to determine them from the surface ($23.9M)
- **Environmental Remediation Sciences** – extending the frontiers of methods for environmental remediation - developing innovative molecular tools for investigating and monitoring environmental processes ($97.4M)

Preparing effective teacher scientists and inspiring America's youth –

- **DOE Academies Creating Teacher Scientists (ACTS)** – Hands-on experience at DOE's labs allows K-14 teachers to make connections between the science and technology principles they teach and become educational leaders ($5.6M)
- **National Science Bowl for High School and Middle School Students** – Providing prestigious academic events to challenge and inspire the Nation's youth to excel in math and science ($1.3M)

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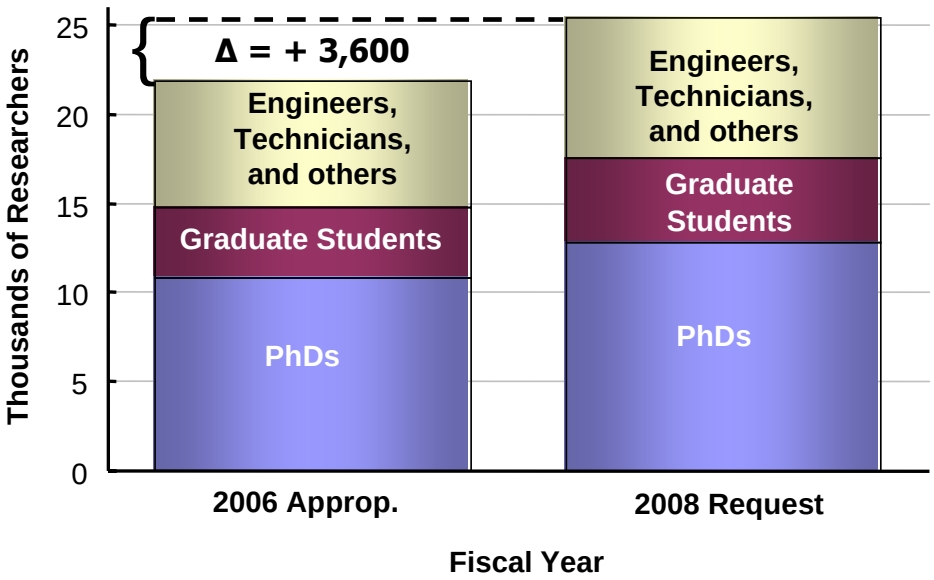
"We must continue to **lead the world in human talent and creativity**. Our greatest advantage in the world has always been **our educated, hardworking, ambitious people** – and we're going to keep that edge."

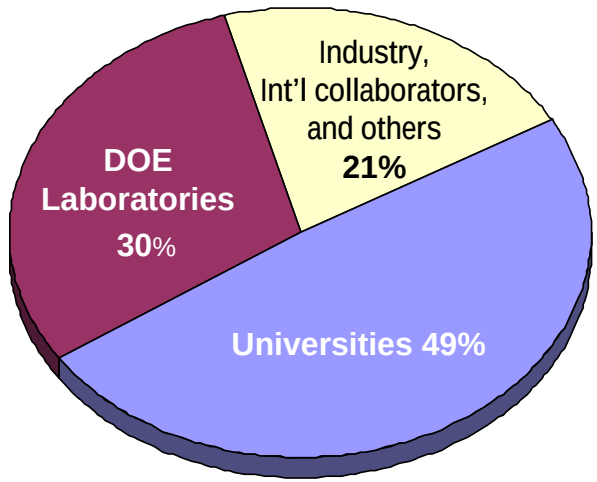
President George W. Bush,
State of the Union Address 2006

- SC supports (FY 2008) the research of about 25,500 Ph.D.'s, Postdoctoral Research Associates, and Graduate Students
- Half of over 21,500 users of the SC's scientific facilities in FY 2008 will come from universities

Scientific Workforce Supported by SC



SC National User Facilities—User Affiliations



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Keeping America at the Forefront of Science & Innovation

Our Nation's current and future energy, environmental, health, and security challenges can be addressed through scientific and technological innovation and a skilled workforce.

The Department of Energy has played an important role in training America's scientists and engineers for more than 50 years, making historic contributions to U.S. scientific preeminence.

Our large-scale scientific facilities and research capabilities lead the world, enabling remarkable discoveries that drive our economy and excite our youth to pursue science and engineering.

The FY 2008 President's request for the Office of Science will help ensure continued U.S. leadership in the physical sciences and prepare the scientific workforce we will need in the 21st century to address our Nation's challenges.

BACKGROUND MATERIALS

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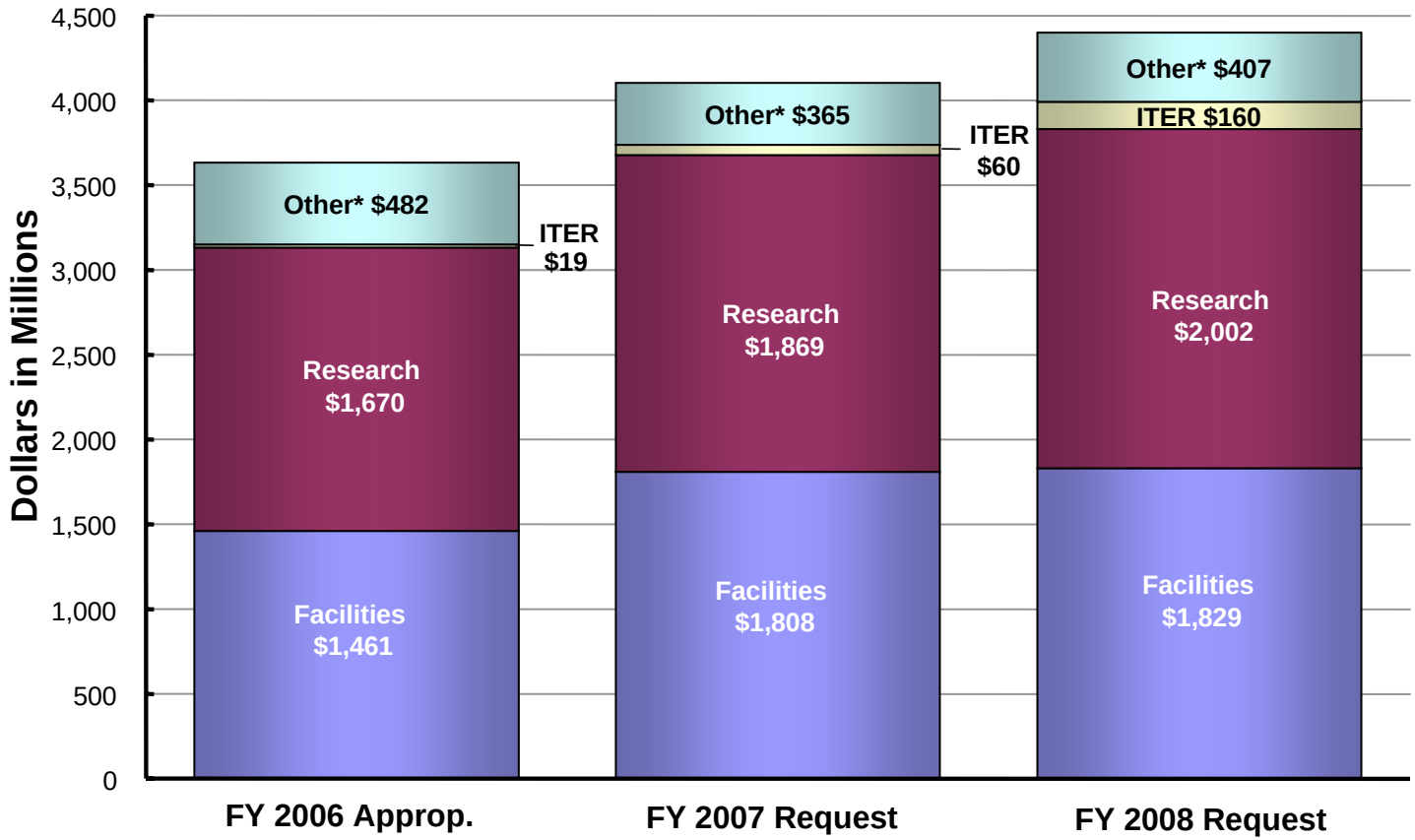
Investments maintain U.S. scientific leadership now and in the future

Office of Science FY 2008 Budget Request



*Other includes Program Direction, Safeguards and Security, other CE/GPP/GPE, and, in FY 2006, Congressionally-directed projects.

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Office of Science Missions

Strengthening U.S. scientific discovery, economic competitiveness, and improving the quality of life through innovations in science & technology

- DOE's Office of Science facilities and instruments provide unmatched capabilities and ensure U.S. leadership in the physical sciences and scientific fields that will transform the 21st century economy – biotechnology, nanotechnology, and high-speed computing
- SC supports DOE's missions through long-term, high-risk, high-payoff multidisciplinary research programs
- We are preparing the Nation's scientific and technical workforce through our support of Ph.D.'s, postdocs, and graduate students, and opportunities for teacher professional development at the DOE national laboratories
- We are stewards for high energy physics, nuclear physics, heavy element chemistry, plasma physics, magnetic fusion, and catalysis
- We support basic research for the development of new sources of energy through transformational technologies – e.g. fusion, novel methods for converting biomass to biofuels, efficient solar conversion, and the future hydrogen economy
- DOE provides 42% of federal support to the physical sciences
- SC provides and maintains ten world-class national laboratories and scientific facilities

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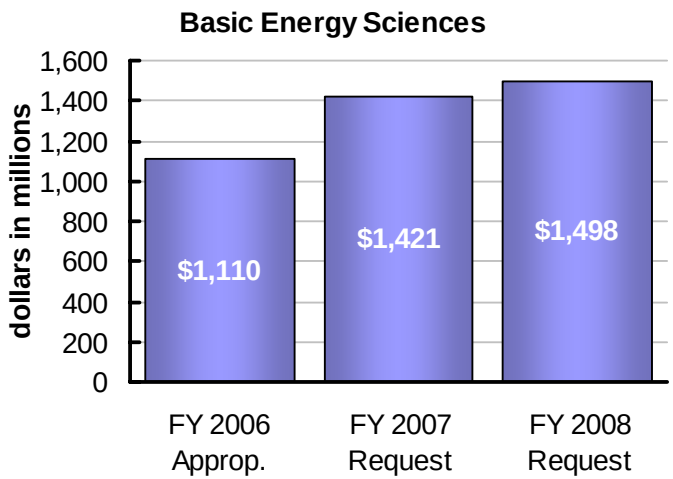
Basic Energy Sciences (BES)

(FY 2008=$1,498M)

- **Core research programs in support of principal investigators.** Research activities are maintained in FY 2008 in areas of condensed matter and materials physics, chemistry, biosciences, and geosciences with increased support in areas of effective solar energy utilization, electric-energy storage, and accelerator physics. (FY2006=$428.0M; FY2007=$535.5M; **FY2008=$582.7M)**
- **Facilities operations.** Facility operations are maintained in FY 2008 to provide for optimal operations of the four light sources and three neutron sources and including operations of the Spallation Neutron Source. (FY2006=$354.4M; FY2007=$493.9M; **FY2008=$508.8M)**
- **Nanoscale Science Research Centers (NSRCs).** All five NSRCs are fully operating in FY 2008. (FY2006=$106.0M; FY2007=$96.6M; **FY2008=$100.5M)**
- **National Synchrotron Light Source II (NSLS-II) Project.** FY 2008 continues Project Engineering Design and R&D for NSLS-II, which will be built as a replacement user facility for NSLS. NSLS-II will provide the world's finest capabilities for x-ray imaging and enable the study of material properties and functions at the nanoscale. (FY2006=$1.9M; FY2007=$45.0M; **FY2008=$65.0M)**
- **Linac Coherent Light Source (LCLS) Project.** The LCLS will continue construction at the planned levels. Funding is also provided to partially support operation of the SLAC linac. (FY2006=117.6M; FY2007=$161.9M; **FY2008=$128.3M**)
- **Instrumentation Fabrication and Other Construction Projects.** Instrumentation for major scientific user facilities and other construction activities. (FY2006=$90.9M; FY2007=$39.0M; **FY2008=$63.2M**)
- **All other.** Includes SBIR/STTR and GPP/GPE. (FY2006=$11.1M; FY2007=$49.0M; **FY2008=$49.8M**)



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Advanced Scientific Computing Research (ASCR)

(FY 2008=$340.2M)

Research in applied mathematics and computer science. (FY2006=$61.1M; FY2007=$69.6M; **FY2008=$82.8M**)

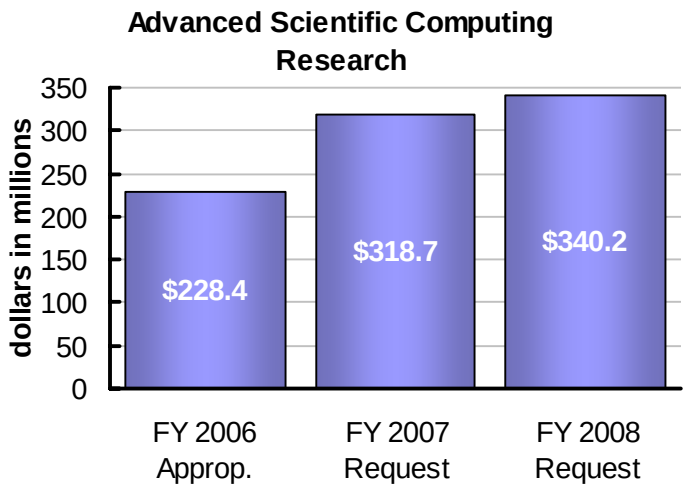
- Advance the underlying mathematical understanding of physical, chemical and biological systems of interest to the DOE.
- Underpin the development of advanced algorithms to describe, model & simulate complex systems.
- Ensure the effective utilization of high-performance computers to advance science for the DOE missions.
- Underpin the use of high-performance networks for science.
- Support Small Business Innovation Research.

Scientific Discovery through Advanced Computing (SciDAC). (FY2006=$48.5M; FY2007=$56.1M; **FY2008=$56.3M**)

- Advances in high-end computation and networking technology and innovative algorithms and software are exploited as intrinsic tools for scientific discovery.
- Scientific Application Partnerships, Centers for Enabling Technologies and university based SciDAC Institutes supported in FY2008.

High-performance computing and network facilities and testbeds. (FY2006=$118.8M; FY2007=$193.0M; **FY2008=$201.1M**)

- Increase support for Leadership Computing Facilities (LCF)
  - Upgrade capability at Oak Ridge LCF to one petaflop by the end of 2008.
  - Upgrade capability at Argonne LCF to 250-500 Teraflops of high-performance computing capability with low electrical power requirements.
- Support high-performance production computing at NERSC
- Support for ESnet to realize the promise of optical networks for DOE's science research missions.



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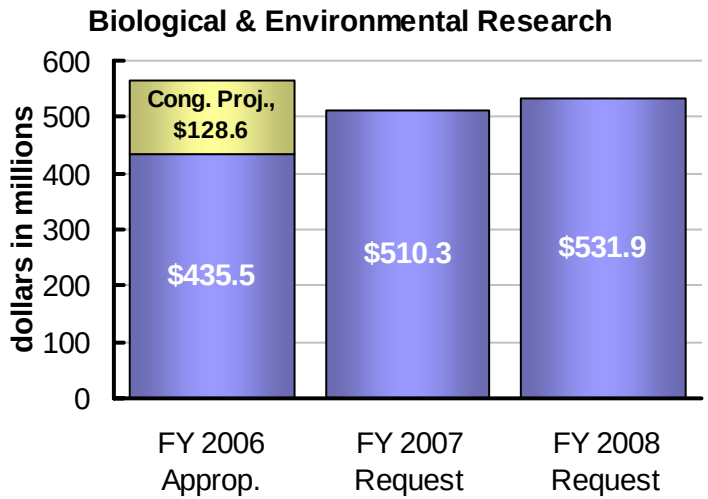
Biological & Environmental Research (BER)

(FY 2008=$531.9M)

- **Core Research Programs.** Research activities are maintained in FY 2008 in genomics; low dose radiation; ethical, legal and societal issues; climate forcing; climate change modeling, forcing and mitigation; environmental microbiology, geochemistry, geophysics and hydrogeology; and medical imaging and instrumentation. (FY2006=$435.5M; FY2007=$510.3M; **FY2008=$531.9M**)
  - **Life Sciences.** Three Bioenergy Research Centers are supported in FY 2008 to accelerate research that could lead to development of cost effective methods for producing cellulose ethanol and other biofuels. The first two will be selected in FY 2007. Genomics: GTL research continues, underpinning biotech solutions for DOE energy/environmental needs. (FY2006=$197.7M; FY2007=$264.1M; **FY2008=$282.3M**)
  - **Climate Change Research.** Supports the Administration's Climate Change Science Program to develop, test and improve climate and Earth System models that simulate and predict responses of climate to increased atmospheric greenhouse gases and aerosols. (FY2006=$136.6M; FY2007=$134.9M; **FY2008=$138.1M**)
  - **Environmental Remediation Research.** Underpins DOE's cleanup mission addressing critical, fundamental questions at the interfaces of biology, chemistry, geology and physics at scales ranging from molecular to field. (FY2006=$91.2M; FY2007=$97.2M; **FY2008=$97.4M**)
  - **Medical Applications & Measurement Science Research.** Supports fundamental research and instrument development in imaging, including development of an artificial retina that allows patients to see large objects. Novel radiopharmaceuticals are also developed using innovative radiochemistry. (FY2006=$138.5M; FY2007=$14.0M; **FY2008=$14.0M**)



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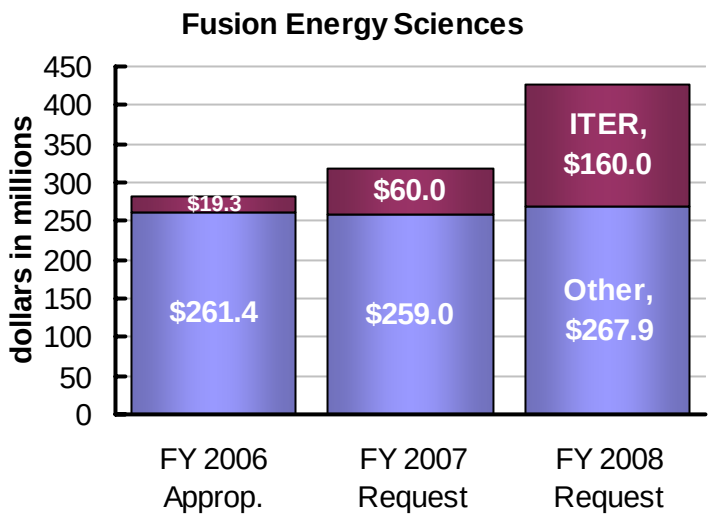
Fusion Energy Sciences (FES)

(FY 2008=$427.9M)

- **The U.S. Contributions to ITER.** Major Item of Equipment (MIE) project will continue. The $160.0M FY 2008 request includes (1) $149.5M Total Estimated Cost (TEC) funding for the U.S. procurement, fabrication, and delivery of medium- and high-technology components, assignment of U.S. personnel to the ITER Organization abroad, provision of cash for the U.S. share of common costs at the ITER site for installation and testing, and contingency for the international ITER organization; and (2) $10.5M Other Project Costs (OPC) funding for the continuation of R&D and design tasks in support of the procurements for the U.S. Contributions to ITER. (FY2006=$19.3M; FY2007=$60.0M; **FY2008=$160.0M**)
- **Operation and research on major facilities.** DIII-D, Alcator C-Mod, and NSTX - will focus on physics issues of interest to ITER. (FY2006=$110.8M; FY2007=$114.6M; **FY2008=$119.2M**)
- **Advanced Computing (SciDAC)** will continue development of plasma simulation tools to facilitate the simulation of burning plasmas . (FY2006=$4.2M; FY2007=$7.0M; **FY2008=$7.1M**)
- **Fabrication of the National Compact Stellarator Experiment** will continue with completion expected in July 2009. (FY2006=$17.0M; FY2007=$15.9M; **FY2008=$15.9M**)
- **Fusion theory and modeling, plasma technology & materials research, experimental plasma research and high energy density physics** Continues in FY2008. (FY2006=$83.7M; FY2007=$73.5M; **FY2008=$75.7M**)
- **Other core research** to develop the knowledge base needed for an economically and environmentally attractive fusion energy source is supported. (FY2006=$45.7M; FY2007=$48.0M; **FY2008=$49.9M**)



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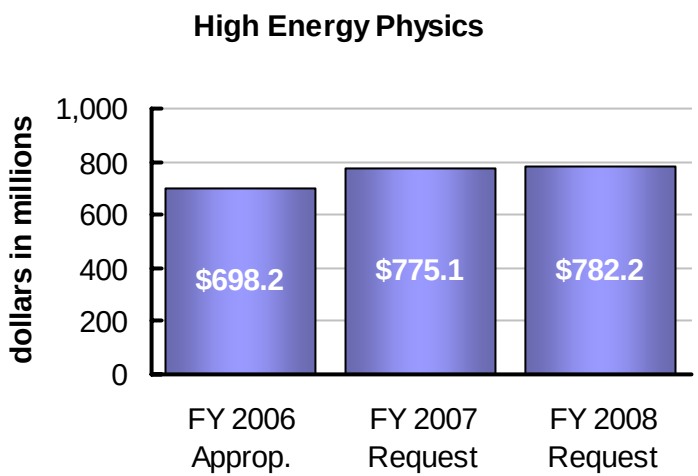
High Energy Physics (HEP)

(FY 2008=$782.2M)

- **Physics Research.** Expands core experimental and theoretical research at universities and laboratories to advance scientific discovery at the Fermilab Tevatron and SLAC B-factory, and prepare U.S. scientists for LHC startup, as well as research associated with new initiatives. Increases accelerator science program to support long-term R&D aimed at inventing new particle accelerator technologies. (FY2006=$299.0M; FY2007=$290.9M; **FY2008=$346.5M***)
- **Facility Operations.** The operating national user facilities achieved new records for performance in FY 2006 (77% increase in peak luminosity at Fermilab and doubling of annual integrated data at SLAC), and are supported at levels that will accelerate scientific data taking in FY 2008. Increased operational support is provided for U.S. researchers participating in the LHC at CERN. (FY2006=$360.6M; FY2007=$375.0M; **FY2008=$299.3M***)
- **Linear Collider R&D.** Funding for ILC R&D is maintained in support of a U.S. leadership role in the international R&D program. (FY2006=$29.7M; FY2007=$60.0M; **FY2008=$60.0M**)
- **Neutrino Program.** Proton accelerator improvements at Fermilab will increase the power of its neutrino beam by 75%; fabrication for the NOvA (electron neutrino appearance) detector. (FY2006=$4.6M; FY2007=$16.8M; **FY2008=$46.0M**)
- **Other.** Includes SBIR/STTR, miscellaneous program activities and proposals awaiting review. (FY2006=$4.2M; FY2007=$32.3M; **FY2008=$30.3M**)

*The apparent changes in these subprogram areas largely reflect a change in the way that certain program overhead-type expenses (e.g., management, computing and engineering support) are charged at Fermilab.



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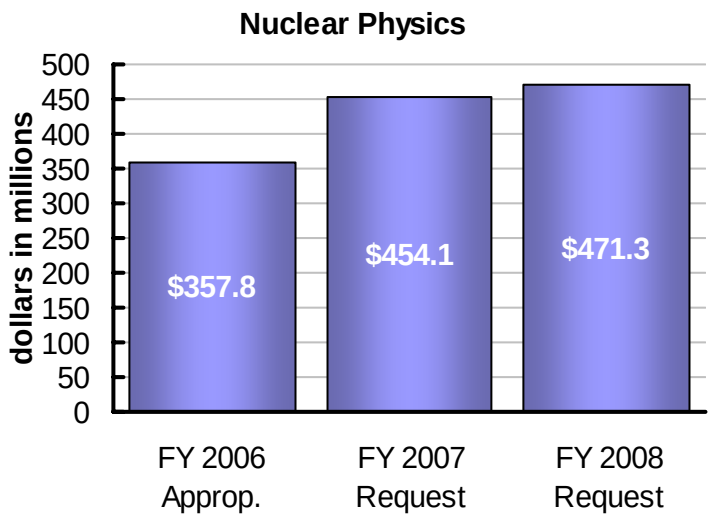
Nuclear Physics (NP)

(FY 2008=$471.3)

- **Core research programs**. University and laboratory researchers will extract new results from studies of hot, dense nuclear matter, the quark structure of matter, nuclear structure & astrophysics, fundamental interactions, and neutrinos. Support is provided for the program's six university centers of excellence. (FY2006=$122.5M; FY2007=$143.3M; **FY2008=$147.6M**)
- **Facility Operations.** The program's four National User Facilities (RHIC, CEBAF, ATLAS and HRIBF) are operated at near optimum levels. The Electron Beam Ion Source (EBIS) being fabricated at RHIC will lead to more cost-effective operations and new research capabilities. (FY2006=$206.2M; FY2007=$256.3M; **FY2008=$258.8M**)
- **Advanced Instrumentation.** Detector upgrades at RHIC and for the heavy-ion program at LHC, the GRETINA detector for nuclear structure studies, a double-beta decay experiment (CUORE) to measure the neutrino mass, and a detector and beamline at the SNS for measurements of fundamental neutron properties. (FY2006=$8.4M; FY2007=$14.5M; **FY2008=$19.2M**)
- **12 GeV CEBAF Upgrade Project.** Project Engineering Design (PED) and R&D proceeds for the upgrade of the beam energy and research capabilities of CEBAF. (FY2006=$4.4M; FY2007=$9.5M; **FY2008=$14.5M**)
- **Accelerator R&D.** Accelerator R&D, including superconducting radio-frequency developments at TJNAF, electron cooling at RHIC and R&D for rare isotope beam capabilities are supported. (FY2006=$6.8M; FY2007=$7.6M; **FY2008=$7.6M**)
- **Stewardship Responsibilities.** Laboratory infrastructure, Small Business Innovative Research (SBIR), Scientific Technology Transfer Research (STTR), etc. (FY 2006=$9.2M; FY2007=$22.7M; FY 2008=$23.6M)



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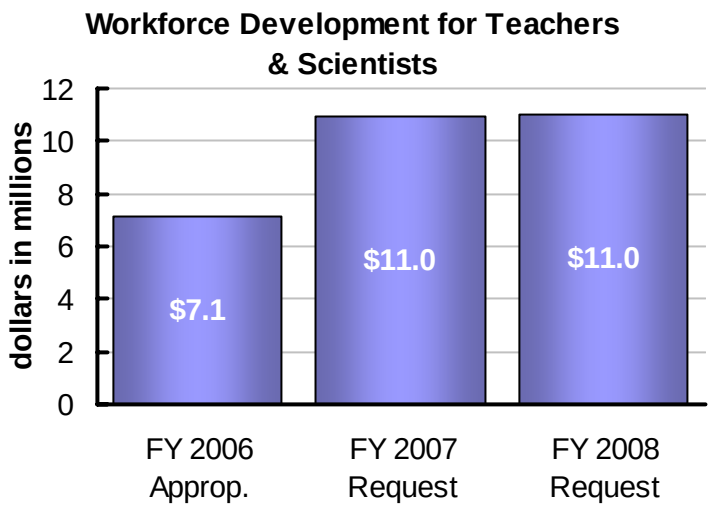
Workforce Development for Students & Teachers (WDTS)

(FY 2008=$11M)

- **DOE Academies Creating Teacher Scientists (DOE ACTS) –** formerly the Laboratory Science Teacher Professional Development (LSTPD). DOE ACTS was a new program in FY 2004 for 60 teachers. K–12 teachers make a three-year commitment to the ACTS program. FY2008 funding will allow for a total of about 300 teachers (27 new and 273 continuing). (FY2006=$1.6M; FY2007=$5.6M; **FY2008=$5.6M**)
- **Faculty and Student Teams (FaST).** FaST teams from colleges and universities with limited research capabilities are provided focused research projects in collaboration with National Laboratory scientists to establish a long-term research partnership with the visiting faculty. (FY2006=$335,000; FY2007=$243,000; **FY2008=$243,000**)
- **Other Graduate/Faculty Fellowship activities.** Einstein Fellowships and Energy Related Laboratory Equipment are supported. (FY2006=$840,000; FY2007=$834,000; **FY2008=$740,000**)
- **Undergraduate Research Internships – Science Undergraduate Laboratory Internship (SULI), Community College Institute (CCI), and Pre-Service Teachers (PST).** Undergraduate students participate in a mentor intensive research experience at one of the National Laboratories. (FY2006=$2.9M; FY2007=$3.1M; **FY2008=$3.1M**)
- **National Science Bowls (High School and Middle School).** The science bowls provide a prestigious academic event, science seminars, and a hands-on model hydrogen fuel cell car race. (FY2006=$1.3M; FY2007=$1.1M; **FY2008=$1.3M**)



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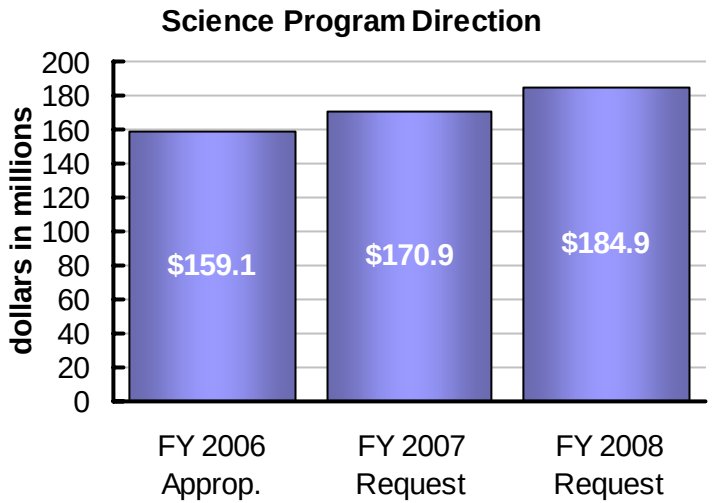
Science Program Direction (SCPD)

(FY 2008=$184.9M)

The FY 2008 SCPD increase supports:

- **Salaries and Benefits:** increase program/project managers and associated support staff to manage the growth under the ACI and address concerns of recent Committee of Visitors (COV) reports; annual pay raise; enhanced recruitment and relocation/retention bonuses;and functional transfer of staff from the New Brunswick Laboratory.
- **Congressionally mandated competition of laboratory contracts:** travel & short-term expertise
- **Information Management Systems/Infrastructure:** current operating levels for maintenance & operation
- **e-Gov initiatives:** (Standard Accounting and Reporting System, E-travel, Business Gateway, Integrated Acquisition Environment, Grants.gov) and IT project management training



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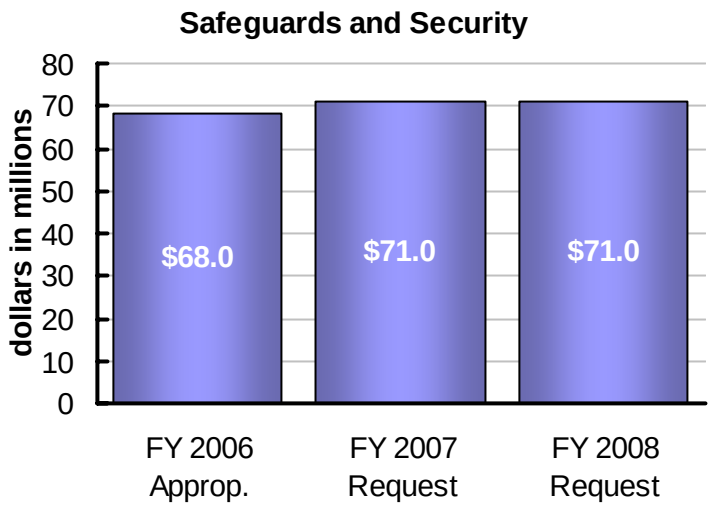
Safeguards & Security (S&S)

(FY 2008=$71.0M)

The mission of the Office of Science Safeguards and Security program is to ensure appropriate levels of protection against: unauthorized access, theft, diversion, loss of custody, or destruction of Department of Energy assets and hostile acts that may cause adverse impacts on fundamental science, national security or the health and safety of DOE and contractor employees, the public or the environment.

- The Safeguards and Security program will perform cyber security enhancements to comply with the Federal Information Security Management Act (FISMA) and OMB mandated national standards and guidance.

- The FY 2008 request includes costs for maintaining the 2003 Design Basis Threat (DBT).



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Science Laboratory Infrastructure (SLI)

(FY2008=$79.0M)

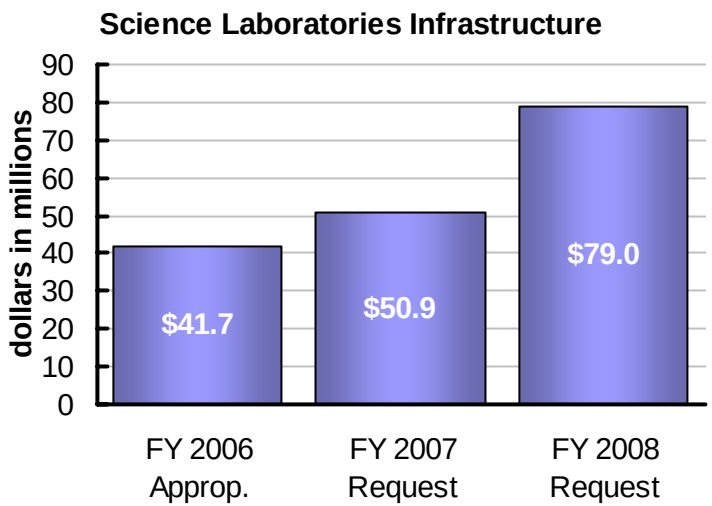
The SLI program supports SC mission activities at SC laboratories by addressing needs related to general purpose infrastructure, excess facilities disposition, Oak Ridge landlord and Payment-in-Lieu-of-Taxes (PILT).

Summary of FY 2008 Budget:

- **General Purpose Infrastructure Construction.** Supports four line item construction projects: BNL Renovate Science Laboratories, Phase I; ANL Building Electrical Service Upgrade, Phase II; ORNL Modernize Building 4500N, Wing 4, Phase I; and LBNL Seismic Safety Upgrade of Buildings, Phase I. Funding is held in reserve pending resolution of issues related to the PNNL Capability Replacement effort. If these issues are resolved, DOE will initiate a reprogramming request to use these funds for replacing and/or upgrading mission-critical facilities currently in the Hanford Site 300 Area.

- **Excess Facilities Disposition.** Supports six projects to clean-up/remove 22,000 sq. ft. of excess space at ANL, BNL and ORNL, to reduce operating costs, ES&H liabilities, and free up land for future use. Funding continues for demolition of the Bevatron Complex at LBNL.

- **Oak Ridge Landlord.** Supports activities to maintain continuity of operations at the Oak Ridge Reservation (ORR), including Federal facilities in the town of Oak Ridge.



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GTL Bioenergy Research Centers: Harnessing Nature's Capabilities

- **The FY 2008 request supports three Bioenergy Research Centers**
- **Centers will be selected in FY2007: $25 million** per Center per year to be provided **over five years** to establish and operate. Centers will be set up and operational by the end of FY 2008.
- Goals: **transformational discoveries** in basic science to make production of **cellulosic ethanol**, sunlight-to-fuels, and other biofuels truly cost-effective and economically viable
- Method: advanced systems biology research on **microbes** and **plants** - to learn to exploit nature's own conversion methods, plus develop a new generation of optimized bioenergy crops
  - Understand metabolic pathways in microbial bioconversion processes
  - Analyze plant cell wall structure and assembly
  - Fine-tune microorganisms and plants to each other
  - Pursue both microbial and bio-mimetic conversion methods
- Innovative multidisciplinary approach: **no construction, rapid start-up** – utilizing **latest biotechnology advances** plus **world-class instruments in DOE complex** (high-intensity light sources, etc.)
- **Open competition**: universities, national labs, nonprofits, private firms, and **partnerships** of such entities invited to compete to establish a Center

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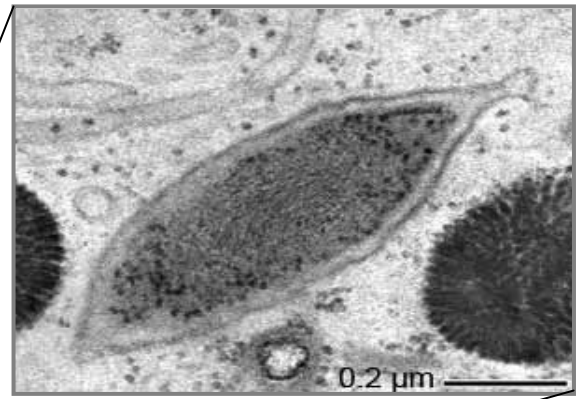
How Nature Does It: Powerful Capabilities of Microbes

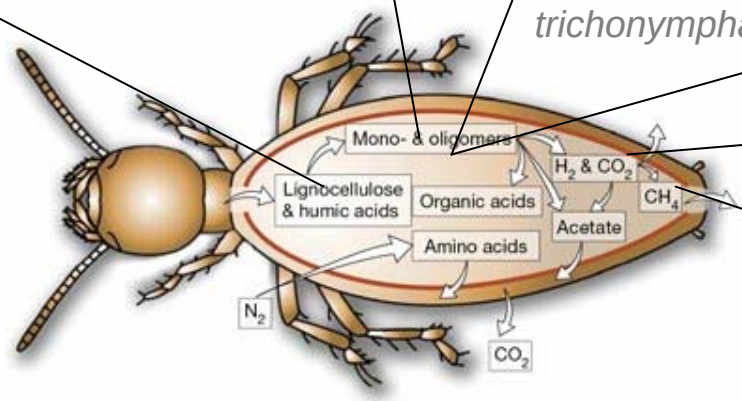
The termite's gut contains about 200 different species of bacteria, some of which are "experts" at breaking down cellulose and helping transform it into fuel in the form of hydrogen and methane.



"Candidatus Endomicrobium trichonymphae"

Enzymes that break down cellulose and hemicellulose

Fermentation pathways



Hydrogen production

Methane production

JGI DOE JOINT GENOME INSTITUTE US DEPARTMENT OF ENERGY OFFICE OF SCIENCE

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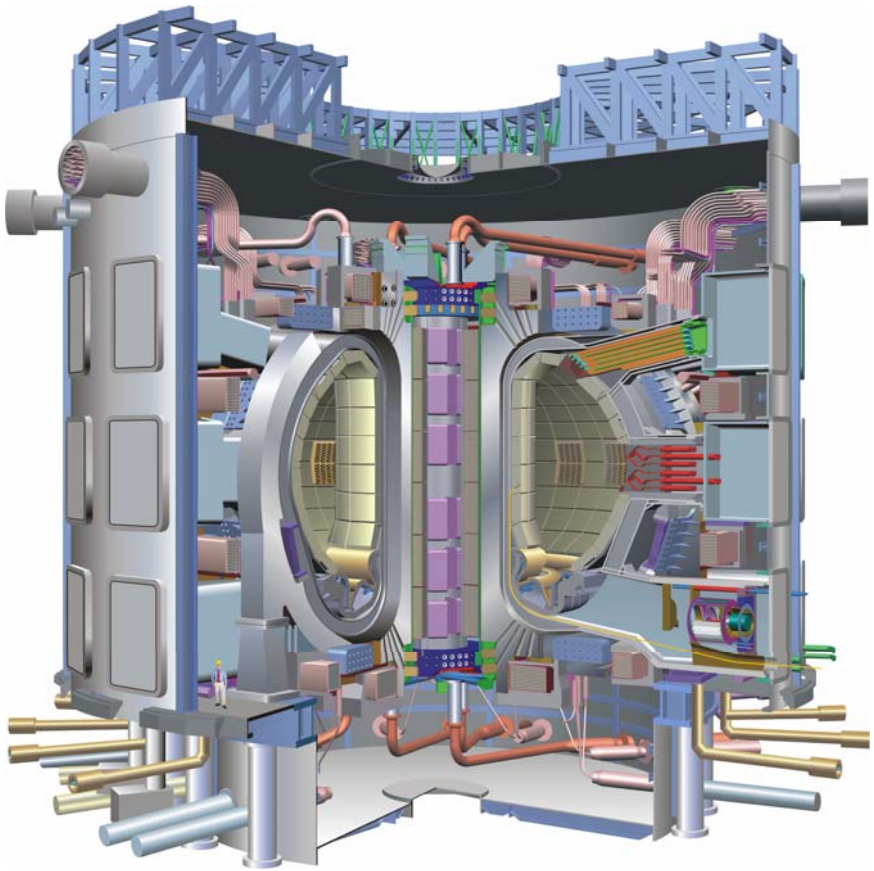
ITER – An international fusion experiment

"I am pleased to announce that the United States will join ITER, an ambitious research project to harness the promise of fusion energy, "
President George W. Bush, January 30, 2003



500 MW thermal fusion power
400 sec pulse length

Science Benefits:
Extends fusion science to larger size, commercially relevant, burning (self-heated) plasmas.

Technology Benefits:
Commercial power plant and other relevant fusion technologies.
High duty-factor operation.

Objective:
"To demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes."

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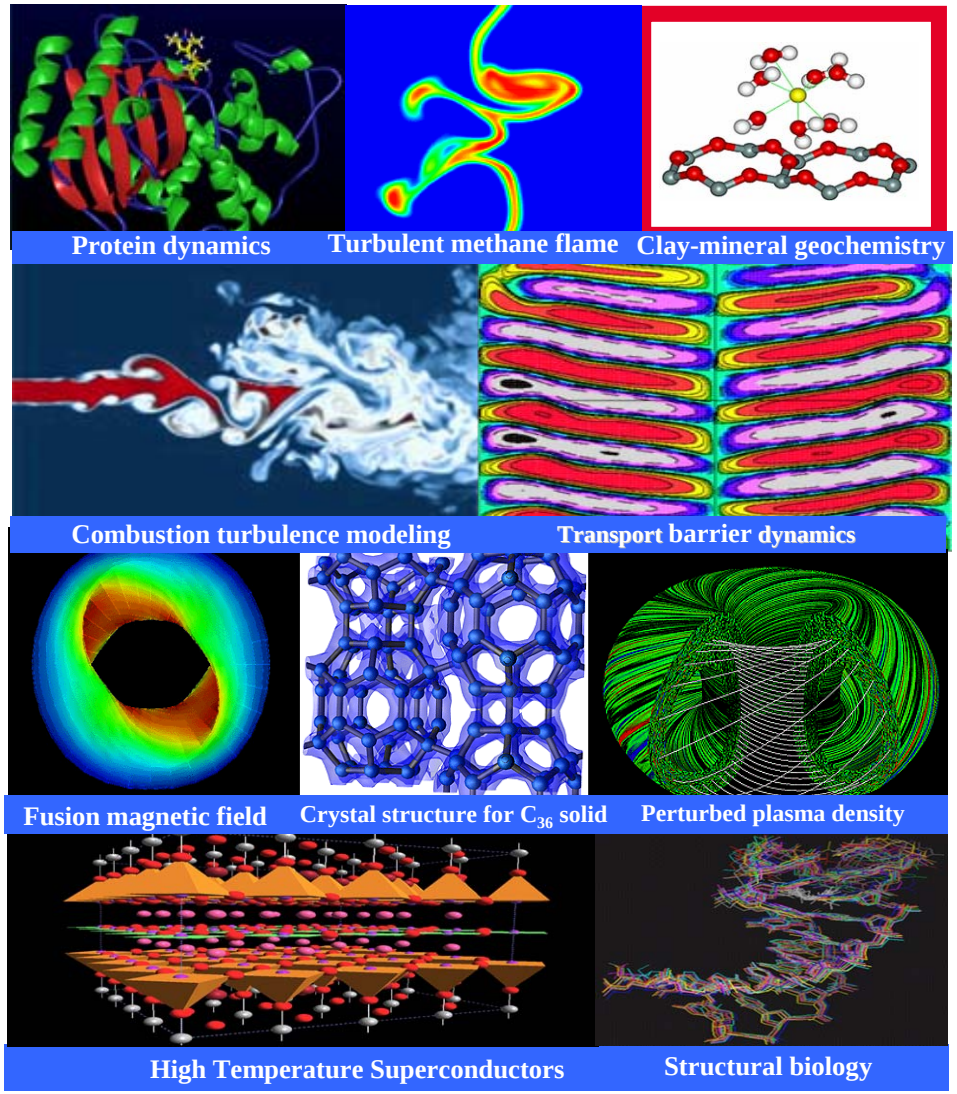
Supercomputers and the Latest Generation of Codes Hold Enormous Potential for Energy Applications

- **Joins experimentation and theory as a main source of scientific discovery**
- **Advances in computation will impact energy goals on many fronts:**
  - Radically new materials designed at the nano-scale for desired performance characteristics
  - Design of improved combustion systems and emissions control
  - Improved catalysts for industrial processes
  - Improved design of fusion experiments such as ITER
  - Harness biology for carbon sequestration and energy production
  - New materials for solar energy



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Nanoscale Science Research Centers: Unique Resources, Unique Capabilities

The Molecular Foundry

Lawrence Berkeley National Laboratory

Unique Resource
- Advanced Light Source
- National Center for Electron Microscopy
- NERSC Computing Center

Scientific Focus
- E-beam nanowriter
- Nanofabrication (lithography and stamping)
- Inorganic nanostructures (crystals and tubes)
- Imaging, manipulation, theory and modeling
- Bio-nanostructures (organic, polymers)

Center for Integrated Nanotechnologies

Sandia National Laboratories / Los Alamos National Laboratory

Unique Resource
- Los Alamos Neutron Science Center
- National High Magnetic Field Laboratory

Scientific Focus
- Nano-bio-micro interfaces
- Nanophotonics and nanoelectronics
- Complex functional nanomaterials
- Nanomechanics
- Theory and simulation

Center for Functional Nanomaterials

Unique Resource
- National Synchrotron Light Source

Scientific Focus
- Nanoscale strongly correlated oxides
- Charge transfer on the nanoscale
- Nanometer-thick organic films
- Nanoscale magnetism
- Nanostructured catalysts
- Nanomaterials applications

Brookhaven National Laboratory

Center for Nanoscale Materials

Argonne National Laboratory

Unique Resource
- Advanced Photon Source
- Electron Microscopy Center

Scientific Focus
- Advanced magnetic materials
- Nanocrystalline diamond
- Complex oxides
- Nanophotonics
- Bio-inorganic hybrids
- X-ray nanoprobe characterization
- Simulations of self-organization

Center for Nanophase Materials Sciences

Unique Resource
- Spallation Neutron Source
- High Flux Isotope Reactor

Scientific Focus
- Neutron scattering to probe materials at the nanoscale, at interfaces, and in complex nanophase materials
- Synthesis and nanofabrication
- Nanomaterials Theory Institute
- Hybrid soft/hard materials
- Organic/inorganic nano-interfaces

Oak Ridge National Laboratory

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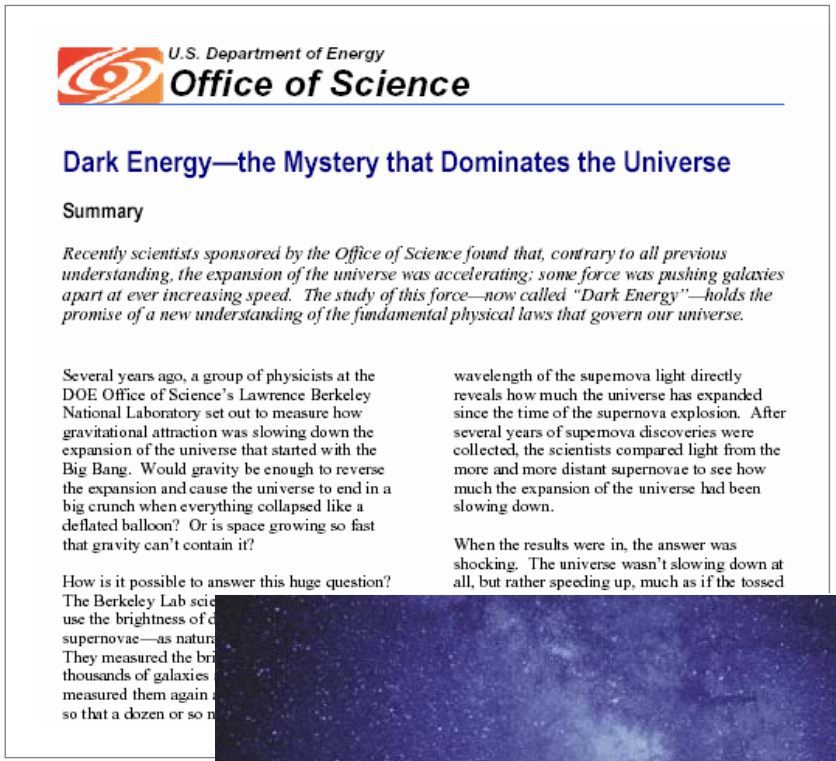
An Exciting Time for Physics:

Key Questions



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Dark Energy—the Mystery that Dominates the Universe

Summary

Recently scientists sponsored by the Office of Science found that, contrary to all previous understanding, the expansion of the universe was accelerating; some force was pushing galaxies apart at ever increasing speed. The study of this force—now called "Dark Energy"—holds the promise of a new understanding of the fundamental physical laws that govern our universe.

Several years ago, a group of physicists at the DOE Office of Science's Lawrence Berkeley National Laboratory set out to measure how gravitational attraction was slowing down the expansion of the universe that started with the Big Bang. Would gravity be enough to reverse the expansion and cause the universe to end in a big crunch when everything collapsed like a deflated balloon? Or is space growing so fast that gravity can't contain it?

How is it possible to answer this huge question? The Berkeley Lab sci
use the brightness of d
supernovae—as natur
They measured the bri
thousands of galaxies
measured them again
so that a dozen or so n

wavelength of the supernova light directly reveals how much the universe has expanded since the time of the supernova explosion. After several years of supernova discoveries were collected, the scientists compared light from the more and more distant supernovae to see how much the expansion of the universe had been slowing down.

When the results were in, the answer was shocking. The universe wasn't slowing down at all, but rather speeding up, much as if the tossed

- What is the dark matter?
- What is the nature of the dark energy?
- How did the universe begin?
- Did Einstein have the last word on gravity?
- What are the masses of the neutrinos, and how have they shaped the evolution of the universe?
- How do cosmic accelerators work and what are they accelerating?
- Are protons unstable?
- Are there new states of matter at exceedingly high density and temperature?
- Are there additional space-time dimensions?
- How were the elements from iron to uranium made?
- Is a new theory of matter and light needed at the highest energies?

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Facilities for the Future of Science

A Twenty-Year Outlook

In operation or current competition:

- Leadership Computing Facilities ($105.0M)
- GTL: Three Research Centers ($75.0M)
- ESnet Upgrade ($24.3M)
- NERSC Upgrade ($54.8M)

In construction, pre-construction or fabrication:

- ITER ($160.0M)
- Linac Coherent Light Source ($76.9M)
- Transmission Electron Aberration-corrected Microscope ($6.7M)
- National Synchrotron Light Source–II ($65.0M)
- CEBAF Upgrade ($14.5M)
- Double Beta Decay Detector ($0.5M)

In R&D or design phase:

- JDEM/SNAP – Rare Isotope Beam Facility (RIBF)
- Linear Collider – Spallation Neutron Source (SNS) Power Upgrade – SNS 2nd Target Station – Next-Step Spherical Torus – RHIC II
- Super Neutrino Beam – ALS Upgrade – APS Upgrade – eRHIC – HFIR 2nd Cold Source – Integrated Beam Experiment