

## The Department of Energy in the FY 2006 Budget

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### HIGHLIGHTS

- In reducing funding for the Department of Energy's (DOE) R&D programs by 2.6 percent the President once again has turned a deaf ear to calls from industrial leaders and his own Council of Advisors on Science and Technology (PCAST) to provide greater federal investments in the physical sciences. The Administration's proposed reduction of the Science account by 4.5 percent (see Table II-11) might be construed as sharp rebuke to Congress, which last year intervened resolutely to mitigate White House damage to the DOE's science portfolio.

-Projections by the Office of Management and Budget for the next three years would perpetuate the proposed FY 2006 trimming of DOE's R&D activities, which account for more than 40 percent of all federal funding for the physical sciences. DOE would stand to lose more than 20 percent of its R&D capability by the time the President leaves office.

- On the civilian side of the DOE ledger, only four R&D activities would see increases beyond inflation: Hydrogen R&D, a presidential initiative; Nuclear Energy, except for university reactors and education assistance; Fusion Energy Sciences, principally funding for the International Thermonuclear Experimental Reactor (ITER); and Coal Research – another presidential initiative – dominated by Sequestration. Elsewhere, shortfalls in the national laboratory operations budgets, estimated by DOE to be approximately \$100 million, would wreak havoc with running schedules at a number of user facilities, among them the Relativistic Heavy Ion Collider (RHIC), a jewel in the DOE's physics portfolio, that would suffer a 61 percent reduction in utilization. Construction of some new facilities and planned upgrades of some existing facilities would also be cancelled or delayed indefinitely. And university research funding might fall by as much as 10 percent.

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- Reflecting the stringency of the Department's budget, the defense side of DOE's ledger – a perennial favorite of the Bush Administration – would receive an increase only for Nonproliferation and Verification activities and Stockpile Services. The Administration continues to press for R&D for the controversial Robust Nuclear Earth Penetrator (RNEP) that Congress declined to fund last year. But perhaps chastened by the congressional response, the President is requesting only \$4.0 million, rather than the \$27.6 million he asked for last year.

## **INTRODUCTION**

The Department of Energy (DOE) is one of the principal investors in federal R&D. Among government agencies, it ranks first in supporting physical science research and first in supporting national facilities. It ranks second in mathematics and computer science. Its research programs play an extraordinarily important role in training the next generation of scientists and engineers. University researchers, for example, receive slightly more than 15 percent of the Office of Science budget directly, and in many fields, including the life sciences, they rely heavily on the facilities DOE operates at its national laboratories.

Traditionally, about half of DOE's R&D budget is allocated to developing, building and operating federally funded research and development centers (FFRDCs), including multipurpose, specialized civilian and national weapons laboratories. These centers, long regarded as jewels in the nation's R&D enterprise, contain many large facilities, such as synchrotron light sources, neutron reactors, specialized accelerators and super computers, which are used by scientists and engineers in universities, industry and other federal research agencies.

The FFRDCs also provide excellent opportunities for interdisciplinary activities. Today, for example, biomedical researchers constitute more than 40 percent of the users of the synchrotron-radiation facilities that are developed and maintained by accelerator physicists, optical scientists, vacuum engineers and computer scientists. And teams of scientists at FFRDCs, drawn from different fields, tackle complex problems, ranging from the environment to nuclear safeguards.

The missions of the FFRDCs also evolve over time to meet changing needs and to take advantage of technological advances. The Stanford

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Linear Accelerator Center (SLAC), for example, developed for high-energy physics in the 1960's, today devotes an increasing fraction of its resources to the material sciences, biological sciences and cosmology.

Some research fields could not survive in the U.S. without the FFRDCs. Particle accelerators at SLAC and Fermi National Laboratory, for example, are the focus of U.S. high-energy physics, while the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory and the Continuous Electron Beam Accelerator at Thomas Jefferson National Laboratory represent a major focus of the nuclear physics community.

### **POLITICAL ENVIRONMENT**

Despite DOE's prestigious scientific record and the high marks the Office of Management and Budget accords its science programs, its research budgets have not fared very well for at least two decades. During this time the purchasing power of the Office of Science has declined by more than a third.

With only one Under Secretary assigned to all civilian activities, the DOE organization chart restricts the visibility of the science programs by relegating them to a Director who holds the rank of a fourth-level administrator, despite the \$3.6 billion budget authority that he currently manages. Historically, Science has lost out to DOE Environmental Management programs in the internal battle for departmental resources. And once the DOE budget reaches the Hill, it must compete with water projects that are perennial favorites of Members of Congress.

The Department's science programs have had staunch influential advocates on Capitol Hill in recent years, among them Senators Domenici (R-NM), Reid (D-NV), Alexander (R-TN) and Bingaman (D-NM) and Representatives Hobson (R-OH), Visclosky (D-IN), Biggert (R-IL), Holt (D-NJ), Ehlers (R-MI) and Boehlert (R-NY). Last year, more than half the Senate – 55 members in all – signed a letter urging their fellow appropriators to provide significant resources for the Office of Science. But over the years, the fight for resources for the well-run Office of Science has proven difficult, in part because many government officials hold DOE as a whole in relatively low esteem.

The DOE traces its origin to 1946, when Congress established the Atomic Energy Commission (AEC) to oversee the nation's embryonic

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nuclear weapons and civilian nuclear reactor programs. In 1974, responding to the national energy crisis, Congress consolidated energy R&D programs housed throughout the federal government and combined them with the non-regulatory activities of the AEC to create the Energy Research and Development Administration (ERDA). In 1977, when ERDA achieved Cabinet status, it was renamed the Department of Energy.

DOE has been saddled with the bureaucratic layers that accompanied its transplanted components, and on the few occasions when the Department has made serious attempts to eliminate administrative redundancy, members of Congress have intervened to preserve DOE jobs in their own districts. Security and safety lapses and toxic waste spills, sometimes perceived to be more serious than were actually the case, have also marred the Department's reputation. Unfortunately, the successes of DOE's stellar scientific portfolio have often been lost in the accusatory rhetoric that these difficulties have engendered.

Last year, having made significant strides in clean-up of waste sites, the Department signaled that it would begin to ramp down the budget for the Environmental Management programs and shift funding into research programs in the FY 2006 budget request. The Department would follow through on one half of its promise, proposing to cut the total Environment program by 6.4 percent or \$502 million. But it would renege on the other half, proposing to reduce R&D in the Science budget as well, by \$150 million or 4.5 percent, as shown in Table II-11.

Some observers have attributed the DOE's reversal on its policy and budget for Science to White House displeasure over congressional action last year that boosted Science spending by 3.8 percent in the face of the Department's proposed 2.0 percent cut.

Conceivably, Congress could intervene again in the FY 2006 budget, since the Administration's plan would reduce the Science program level of effort by more than 8 percent, taking into account inflation in research costs. This would come at a time when the United States faces increasingly strong foreign competition in the technology sector – as detailed in a benchmark study released by the Task Force on the Future of American Innovation in February<sup>1</sup> – particularly from Asian countries, including China, Taiwan, South Korea and Japan.

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<sup>1</sup> See [www.futureofinnovation.org](http://www.futureofinnovation.org).

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A final comment on the political environment in which the FY 2006 budget will find itself concerns Yucca Mountain, the long-term, high-level nuclear waste facility that the Bush Administration approved a year ago. Last year, the presidential request assumed the transfer of \$749 million from a special fund, authorized by the Nuclear Waste Policy Act, into which nuclear power producers have been making mandatory payments (0.1 cent per kilowatt hour of nuclear electricity generated) since 1983 for the ultimate disposal of spent fuel rods. The authorizing legislation required for the transfer proved politically impossible to achieve in the Senate, where it was blocked in a bipartisan move by Senators Harry Reid and John Ensign of Nevada, and the appropriations bill was held up for lack of a funding source. This year, the Administration's budget would provide Yucca Mountain funding within the context of the DOE appropriations bill, but at the much-reduced level of \$75.9 million, as the Department proceeds with its request to the Nuclear Regulatory Commission for licensing of the repository.

### **FUNDING REQUEST AND PRIORITIES**

**Overview:** The presidential FY 2006 budget request proposes cutbacks in most of DOE's R&D activities, in many cases so severely that they would place the future viability of some programs and facilities at extraordinary risk. In the Office of Science alone, the Department estimates the budgetary shortfall for national user facilities at \$100 million, and proposes substantial cuts in their operation. Particularly hard hit would be two nuclear physics facilities, RHIC at Brookhaven and the Continuous Electron Beam Accelerator Facility (CEBAF) at Thomas Jefferson National Laboratory. Laboratory directors across the country have already been advised to plan for technical staff reductions, and the Department is expected to call upon the Nuclear Science Advisory Committee (NSAC) to evaluate the relative merits of RHIC and CEBAF in the event one of them would have to be closed.

On a positive note, the Department would commit funding to begin construction of the Linac Coherent Light Source (LCLS – an X-ray free-electron laser) at the Stanford Linear Accelerator Center (SLAC); to begin fabrication of components for the International Thermonuclear Experimental Reactor (ITER – a project for which the site is likely to be in France or Japan); and to increase R&D funding for the International Linear Collider (ILC – a High-Energy Physics project that is still at a

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formative scientific and technical stage). But it would cancel or delay several new projects, among them Fermi National Laboratory's "B Physics at the Tevatron" (BTeV), the Rare Isotope Accelerator (RIA) and the NASA-DOE space based "Joint Dark Energy Mission." It would also slow down the planned upgrade of CEBAF.

The presidential budget would boost overall funding for energy research, but only the President's Hydrogen Initiative and Nuclear Energy would benefit. It would balance these increases with decreases in other activities, such as Energy Conservation, Energy Efficiency, Renewables, and Fossil Energy R&D. And perhaps in response to antiterrorism recommendations, the Department would increase funding for Nonproliferation and Verification activities, although overall, Atomic Energy Defense R&D budgets would fall by 2.6 percent.

**Energy Supply:** The Hydrogen Initiative is featured prominently throughout the presidential DOE request. Across programs, the Administration would increase Hydrogen R&D by 15.2 percent to \$258 million, \$203 million of which would reside in the Energy Supply account (\$183 million within the Energy Efficiency and Renewable Energy program and \$20 million for the Nuclear Hydrogen Initiative). The Department would also commit \$22 million for Hydrogen under the Fossil Energy program, which would absorb \$17.8 million for FutureGen within the Clean Coal Power Initiative (CCPI) and \$33 million within programs of the Office of Science. Overall, Energy Supply R&D would decline 6.4 percent, with most programs declining, other than Wind Energy (up 8.4 percent to \$44.2 million), Nuclear Energy (up 11.8 percent to \$95.0 million) and the President's Coal Research Initiative (up 4.8 percent to \$286.0 million).

Solar Energy would decline by 1.3 percent to \$84.0 million; Hydropower would all but disappear, falling 89.7 percent to \$0.5 million; Geothermal Technology would lose 7.8 percent to \$23.3 million; and Biomass and Biorefinery Systems would decline 37.7 percent to \$50.4 million.

Although the Nuclear Hydrogen Initiative would be the big winner in Nuclear Energy R&D, the Administration, perhaps sensing a more receptive public, would reverse its previous years' posture and increase spending on a number of Nuclear Energy programs. The Advanced Fuel Cycle Initiative would receive \$70.0 million, up 3.8 percent; the Generation IV Nuclear Energy Systems Initiative would receive \$45.0

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million, up 13.4 percent; and Nuclear Power 2010 would receive \$56.0 million up 12.9 percent

**Science:** The DOE regards Science as one of its four pillars, complementing Defense, Energy and the Environment. The Department states that its Science programs “protect our national security by providing a world-class scientific research capacity and advancing scientific knowledge.” Last year, amid much fanfare, the Office of Science released two carefully conceived reports, a strategic plan and a 20-year facilities plan. Both of these documents, developed with considerable participation by the science community, received the endorsement of the Secretary of Energy and found a ready audience in Congress. Should the cuts proposed in the FY 2006 presidential budget materialize, both of these plans have little chance of being implemented.

High-Energy Physics, DOE’s second-largest Science program, funded at \$714 million in the FY 2006 request would decline 3.1 percent from its FY 2005 level of \$736 million. However, the program would be relieved of \$30 million of its total SLAC operation, with the portion associated with the Linac Collider Light Source (LCLS) being assumed by Basic Energy Sciences. Therefore, although the High-Energy Physics budget devoted to SLAC would fall from \$166.2 million to \$144.0 million, SLAC operations would increase to 5,200 hours in FY 2006. Fermilab, the other major U.S. High-Energy Physics facility, would see its budget remain essentially flat, rising a scant \$0.6 million to \$304.2 million, but with all major construction projects completed, the Department projects that accelerator operations would be able to increase 6 percent to 4,560 hours. The Department’s contributions to the Large Hadron Collider in Geneva, Switzerland would fall by \$1.9 million, as an increase in the research budget from \$29.4 million to \$52.6 million compensates for a decline in the construction from \$32.5 million to \$7.2 million. In anticipation of U.S. participation in the International Linear Collider project, the Department would ramp up R&D for that effort by 10.6 percent to \$25.0 million. Finally, Non-Accelerator Physics using underground or space-based facilities would decline 17.8 percent to \$39.0 million, and Theoretical Physics would remain essentially unchanged at \$49 million.

In a dramatic reversal of the Bush Administration’s requests in prior years, the Nuclear Physics program would fall sharply. All subprograms, as shown in Table II-11, would share in the decline. In what some

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observers might regard as paradoxical behavior, the Department, after proposing to increase facilities operating time last year by 34 percent at CEBAF and 16 percent at RHIC, would trim back both this year – by 29 percent at CEBAF and 61 percent at RHIC. The Department would proceed with plans to close down the MIT-Bates Electron Accelerator but would maintain \$7.2 million in funding for the Lawrence Berkeley National Laboratory 88-Inch Cyclotron in support of a small in-house program and U.S. Air Force and National Reconnaissance Office research activities. Finally, although the Rare Isotope Accelerator remains a high priority on DOE's 20-year facilities plan, the Department requests the removal of the \$2.7 million Congress added last year and would roll back funding from \$6.7 million to \$4.0 million for FY 2006. (For more on physics projects at DOE, see Chapter 14.)

Although Fusion Energy Sciences would receive a 6.1 percent increase to \$291 million, only ITER would stand to benefit. The President's spending plan, which reduced operations and research at DOE's three major fusion facilities last year, would continue the reductions in FY 2006, cutting DIII-D down to 5 weeks, Alcator C-Mod down to 12 weeks and NSTX down to zero. Funding for ITER, by contrast, would rise dramatically from \$5 million in FY 2005 to \$56 million in FY 2006.

Basic Energy Sciences (BES), the largest program in the Office of Science at \$1.15 billion, would receive \$41 million more in FY 2006, but of that amount \$30 million would be a transfer to partially support SLAC operation, formerly handled entirely by High-Energy Physics. The LCLS, which uses the linear electron accelerator, would receive an additional \$3.5 million for its own operation. The Spallation Neutron Source (SNS) at Oak Ridge National Laboratory (ORNL), which will be nearly completed this year, would see its operating budget climb from \$33.1 million to \$106.9 million, and four Nano-Science Centers (the Center for Nanophase Materials, the Center for Integrated Technologies, the Molecular Foundry and the Center for Nanoscale Materials) would begin receiving operating funds totaling \$43.2 million. In order to accommodate these new activities within its constrained budget, BES would close the Radiochemical Engineering and Development Center at ORNL and either flat fund or reduce the operating budgets of all other BES facilities. In the aggregate, users of those facilities would experience a 10 percent reduction in beam availability and services. Construction of new facilities would consume \$178 million of the FY 2006 BES budget, down 22.6 percent from last year, reflecting the

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planned profiles for those projects. The SNS construction budget would fall \$38.1 million, and the LCLS budget would climb \$53.2 million. Overall, funding for Material Sciences would increase 17.5 percent to \$746 million. Chemical Sciences, Geosciences and Energy Biosciences, by contrast would decline by 7.5 percent, with every subprogram affected. In each case, the Department explains the cut as reflecting a “one-time increase in FY 2005 for all portfolio elements.” This rather strange language can have only one meaning: in spite of the constitutional separation of powers that places ultimate authority over spending in the legislative branch, the White House rejects as improper the funding increases Congress insisted on last year, even though they were earmark-free. (For more on the nano-science centers, see Chapter 24.)

Advanced Scientific Computing Research, a favorite of the Administration in past years, would decline by 10.9 percent to \$207 million in FY 2006. Funding for the Center for Computational Sciences at ORNL would drop \$42.5 million to \$25.0 million, consistent with completion of evaluation activities, and the National Energy Research Computing Center (NERSC), located at Lawrence Berkeley National Laboratory and boasting 10-teraflop capability, would receive \$37.9 million for operations, as it did last year.

Biological and Environmental Research, the third-largest Science program, would receive \$456 million, down 21.7 percent. But the proposed cut dominantly reflects the elimination of \$79.6 million in congressional earmarks that appeared in the FY 2005 Medical Applications and Measurement Sciences appropriations. The Department would continue to focus major resources on the Human Genome program (\$64.2 million, virtually unchanged from FY 2004) and the Genomes to Life program (\$87.2 million, up 29.0 percent). Structural Biology, by contrast, would decline by 30.1 percent to \$15.3 million.

**Fossil Energy and Energy Conservation:** For the first time, in FY 2006 these programs will receive their funding through the Energy and Water Projects appropriations bill rather than the Interior and Related Agencies bill. The President’s Clean Coal Initiative would see its R&D funding rise by \$13.2 million. Within the Initiative, the FutureGen project (part of the Hydrogen Initiative) would receive \$68.0 million, up 0.9 percent. Sequestration R&D would climb 48.0 percent to \$67.2 million. For the Fossil R&D programs in total, the presidential budget would reduce

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funding by 14.7 percent to \$382 million. Reflecting the Administration's continued emphasis on energy production, the President's budget would cut Conservation R&D again, reducing funding to \$356 million, a decline of 3.0 percent.

**Atomic Energy Defense Activities – National Nuclear Security Administration (NNSA):** Maintaining the nuclear stockpile as a safe, secure and reliable weapons system has been a major challenge for DOE, since the U.S. ceased testing nuclear weapons more than a decade ago. To meet the challenge, DOE developed the Stockpile Stewardship program, the largest component of its Defense R&D portfolio. In past years these R&D activities, comprising Science Campaigns, Advanced Simulation & Computing, Inertial Confinement Fusion and assorted other weapons work, received favored budgetary treatment in the presidential R&D request. This year, as shown in Table II-11, the Administration proposes to reduce the R&D component of the National Nuclear Security Administration substantially, in favor of Directed Stockpile Work that involves maintenance, safety, security and production activities. The Administration, having been rebuffed by Congress last year in its attempt to initiate work on the development of new tactical or low-yield nuclear weapons, including the Robust Nuclear Earth Penetrator (RNEP), would scale back its request to a \$4 million plan for research on RNEP and a \$9 million R&D plan for a Reliable Replacement Warhead to use with the existing stockpile. In a reversal of past years' policies, the Administration also proposes to increase spending on Nonproliferation and Verification, dramatically raising the R&D budget for those activities by 21.4 percent to \$272 million.

**Radioactive Waste Management:** The Department has responsibility for managing and disposing of the nation's spent nuclear fuel and high-level radioactive waste, both civilian and military. Although Environmental Management represents the second largest DOE business line at a proposed spending level of \$7.3 billion, R&D is a very small share of that budget. For FY 2006, the Administration would scale the R&D activities back by 30.2 percent to \$44 million