

DOE R&D Down in 2006 Budget, With Cuts to Office of Science

AAAS R&D Funding Update on DOE in the FY 2006 Budget

(This analysis is a preview of the DOE chapter in the forthcoming *AAAS Report XXX: Research and Development FY 2006*, a comprehensive look at the President's budget for R&D in FY 2006. This analysis contains revised AAAS estimates of DOE R&D, different from figures presented in the AAAS Preliminary Analysis of February 10. More tables and continually updated supplemental materials on R&D in the FY 2006 budget can be found on the AAAS R&D Web site at <http://www.aaas.org/spp/rd>.)

Highlights

- The **Department of Energy (DOE)** would see its R&D funding decline 2.6 percent or **\$221 million to \$8.4 billion** in the FY 2006 budget, after a smaller cut in 2005 (see Table II-11).

- **DOE's Office of Science (OS) R&D would fall 4.5 percent to \$3.2 billion**, down to funding levels not seen since 2000. The cuts would be spread across a broad portfolio of programs in physics, fusion, biology, and energy sciences. Operation times at OS scientific user facilities would be reduced.

- **Energy-related R&D would be a winner** with a 3.2 percent gain to \$1.2 billion because of proposed increases for hydrogen, nuclear energy, fuel cells, and coal R&D. DOE would invest \$257 million (up from \$224 million) in a Hydrogen Fuel Initiative to develop technologies for hydrogen-powered cars. But DOE would eliminate R&D on gas and oil technologies and sharply reduce funding for several renewable energy technologies.

- **DOE's defense R&D investments would fall 2.6 percent to \$4.0 billion**, including cuts to advanced scientific computing and inertial confinement fusion. Although Congress eliminated the controversial Robust Nuclear Earth Penetrator program in 2005, DOE would try again FY 2006 with a request of \$4 million.

The FY 2006 budget request proposes \$23.4 billion for DOE's total budget, a cut of \$475 million or 2.0 percent from this year's funding level. More than two-thirds of DOE's budget goes to defense programs to maintain the nuclear weapons stockpile and to clean up past weapons sites. Most DOE program areas would see cuts in this era of tight budgets, and DOE's R&D programs would be no exception. DOE's R&D, split roughly in half between defense and nondefense missions, would total \$8.4 billion, \$221 million or 2.6 percent below this year's budget (see Table II-11).

R&D in the DOE Office of Science (OS): Cuts for Most Programs

Office of Science (OS) R&D in the FY 2006 budget would fall 4.5 percent or \$150 million to \$3.2 billion, potentially undoing the gains of the past two years (see Table II-11). In inflation-adjusted terms, the OS R&D portfolio would fall to levels last seen in 2000. The Bush Administration proposes to cut OS funding for the fifth year in a row through the proposed elimination of \$80 million in earmarks and cuts in core program funding; in past years, Congress has added to the request for earmarks and other OS programs.

All the major OS accounts would decline in FY 2006, except for Basic Energy Sciences (BES) and Fusion Energy Sciences (see Table II-7). But even in these two accounts, increases for two projects would

leave other BES and fusion programs at or below this year's funding levels. In BES, funding for the Spallation Neutron Source (SNS) in Tennessee would surge \$36 million to \$149 million as the facility transitions from construction to operations. The SNS increase would leave other BES programs flat funded in 2006, although there would be some savings achieved from the transition of four out of five DOE nanoscale centers from construction in 2005 to operations in FY 2006. In Fusion, the request proposes \$56 million for the International Thermonuclear Experimental Reactor (ITER) project, mostly for ITER equipment, up from just \$5 million this year. The \$5 billion international project has been delayed because the international partners have been unable to agree on a site in either Japan or France; more than a year after a deadline to pick a site has come and gone, the six partners are still deadlocked, but the budget request assumes that the project will proceed in time to require an increased U.S. contribution. But although Congress provided extra 2005 funds to ensure that ITER would not crowd out domestic fusion research, the FY 2006 request would cut the rest of the fusion portfolio.

The cuts to OS accounts would decrease operating time and user support at DOE scientific user facilities throughout the portfolio in areas such as nuclear physics, computing, and fusion. The Office of Science operates unique, large-scale research facilities at DOE's national laboratories around the country, which external researchers can use for their own experiments through a competitive proposal process. In recent years, tight budgets (see Figure 1) have squeezed operating time at these facilities, and the FY 2006 budget would squeeze even tighter, with operating times reduced by as much as 61 percent at some OS facilities. The cuts would also impact future facilities: a \$140 million experiment named BTeV at FermiLab in Illinois to study particle physics would be canceled at the conclusion of the engineering design phase in 2005.

In addition to its support of facilities, DOE's Office of Science is also the dominant federal supporter of research in the physical sciences, particularly high-energy physics and nuclear physics. It is also a leading supporter of biological sciences, environmental sciences, computing sciences, and fusion research.

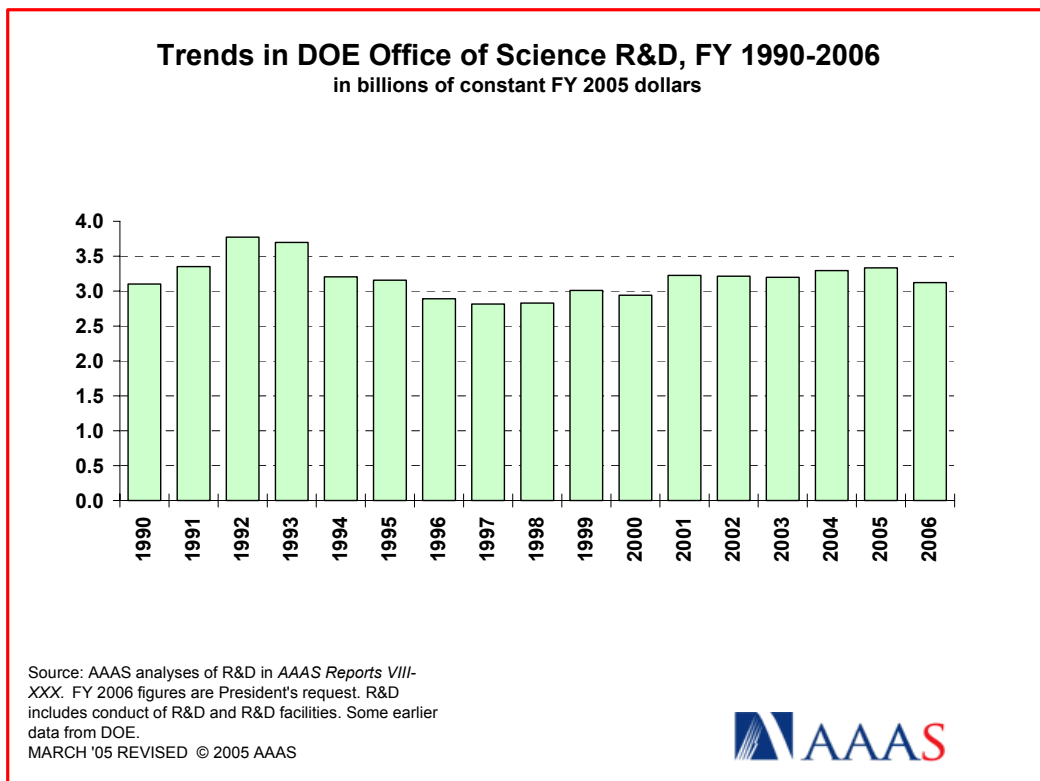


Figure 1. (click on the image for PDF)

After more than a decade of steep cuts and stagnant budgets, the DOE Office of Science has less money now for its R&D programs than it did in the early 1990s (see Figure 1). In today's dollars, the Science program has been stuck at roughly \$3.1 billion since FY 2001, but the FY 2006 budget would represent a sharp downturn compared to the modest increases of the most recent years.

DOE Energy and Defense R&D Programs: Hydrogen and Nuclear Up, Other Areas Down

DOE would boost funding for its energy R&D programs overall but would shuffle funding to boost Administration priorities. The overall DOE energy R&D portfolio would climb 3.2 percent to \$1.2 billion (see Table II-11).

The top priority in the energy request is \$257 million in R&D for a newly organized **Hydrogen Fuel Initiative**, up from \$224 million this year. The nascent multi-agency initiative builds on existing DOE programs, but also enlists the Department of Transportation (DOT) for \$2 million to make it a \$260 million initiative, up 16 percent from 2005. The initiative would tie together DOE efforts in hydrogen production, fuel cells, nuclear hydrogen, hydrogen from coal, and basic science to develop practical technologies for hydrogen-powered cars of the future. Funding would come from the Energy Conservation, Fossil Energy, Nuclear Energy, and Energy Efficiency and Renewable Energy programs, and the Office of Science.

But in order to provide large increases for hydrogen, nuclear energy, and coal R&D, there would be steep cuts and even program eliminations to other energy R&D programs. Fossil Energy R&D funding would fall 15 percent to \$382 million after a similar cut in 2005. But within the total, coal-related R&D would gain 4.9 percent to \$286 million. Having been rebuffed by Congress in last year's proposals to boost funding for the FutureGen program to \$237 million, the FY 2006 request would keep funding for this initiative to build a near-emission-free, coal-fired electricity and hydrogen production plant at \$18 million, but would boost sequestration research to manage coal-burning carbon emissions to \$67 million, up from \$45 million this year. But the budget would eliminate DOE funding for oil and gas R&D, slash funding for cooperative R&D projects, and cut fuel cells R&D. Energy conservation R&D would also decline, by 3 percent down to \$356 million after a similar cut in 2005. Fuel cells R&D in this account would increase by 12 percent to \$84 million and biomass R&D would triple to \$22 million, but there would be steep cuts to R&D on conservation in buildings and industry.

In Energy Supply, Administration priorities for hydrogen and nuclear energy would reshape the portfolio. Nuclear energy R&D would increase 12 percent to \$95 million, with half of the increase going to a nuclear hydrogen initiative to develop nuclear-based hydrogen production technologies. Overall Energy Efficiency and Renewable Energy R&D funding would fall 7.0 percent to \$230 million, with increases for hydrogen R&D offset by cuts in solar, geothermal, hydropower, and biomass R&D.

DOE has responsibility for managing and disposing of the nation's spent nuclear fuel and high-level radioactive waste, both civilian and military. Last year, DOE requested a dramatic increase up to \$275 million for Waste Management R&D as the Yucca Mountain long-term, high-level nuclear waste repository appeared poised to move forward after receiving congressional and White House approvals two years ago. But Congress and the President deadlocked last year on how to fund Yucca Mountain operations and there have been setbacks on other fronts, resulting in a cut for its R&D. DOE is now preparing to submit a license application for the repository to the Nuclear Regulatory Commission in FY 2006. During the delay, DOE's request for waste management R&D would decline further to \$44 million in FY 2006.

On the defense side, most of DOE's R&D is funded by the **National Nuclear Security Administration (NNSA)**, which funds maintenance of the nation's nuclear weapons stockpile through science-based research, mostly in its core Weapons Activities account. R&D in Weapons Activities grew substantially in recent years in lockstep with rapid growth in overall defense spending, from \$2.4 billion in FY 2001 to \$3.2 billion in 2003 and 2004, but now these investments are in decline with a cut in 2005 and a proposed 4.7 percent reduction to \$2.9 billion in FY 2006. Within the overall portfolio, Inertial Confinement Fusion R&D funding falls 14 percent to \$460 million in a retrenchment of the program. DOE's considerable

investments in research computing on the defense side of the budget continue at \$661 million, down 5.2 percent from this year but still triple the computing investment on the nondefense side.

Although Congress eliminated the controversial Robust Nuclear Earth Penetrator program in 2005, DOE would try again FY 2006 with a request of \$4 million. This Administration proposal **to initiate research on a new generation of nuclear weapons**, including the RNEP and other tactical or 'low-yield' nuclear weapons, has been opposed by Congress so far. Congress has repeatedly criticized DOE for continuing to claim that the RNEP is only a research program, while at the same time projecting \$485 million in last year's budget over the next five years, an investment more than sufficient to move the program well into design and development toward eventual production. Such a step would require repealing a U.S. ban on developing new nuclear weapons. Chastened by congressional rejection, the FY 2006 request plans for RNEP research only in 2006 and 2007, no funding for 'advanced concepts' R&D on similar weapons, and no current plans for development funding. But the FY 2006 budget does contain \$9 million for R&D on the Reliable Replacement Warhead, a 5-year, \$98 million project that would explore the possibility of new warhead designs to use with the existing nuclear stockpile.

Elsewhere in DOE, the Nonproliferation and Verification R&D program would receive a 21 percent increase to \$272 million. This program funds R&D, mostly at the DOE national labs, on technologies for proliferation detection and nuclear explosion monitoring. Both parts of the program would receive large increases in 2006.

- March 1, 2005 (REVISED March 18)

(More materials on R&D in the FY 2006 budget, historical data and charts, and more information on *AAAS Report XXX: Research and Development FY 2006*, can be found on the AAAS R&D Web site at <http://www.aaas.org/spp/rd>.)

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Table II-11. Department of Energy R&D

Table II-11. R&D in the Department of Energy
(budget authority in millions of dollars)

	FY 2004 Actual	FY 2005 Estimate	FY 2006 Budget	Change FY 05-06	
				Amount	Percent
Summary of DOE R&D (see notes at end of table):					
1. Energy Supply	382	423	397	-27	-6.4%
2. Science	3,229	3,334	3,184	-150	-4.5%
3. Fossil Energy	547	448	382	-66	-14.7%
4. Energy Conservation	379	367	356	-11	-3.0%
5. Atomic Energy Defense	4,198	4,138	4,031	-107	-2.6%
6. Clean Coal Technology 1/	-98	-160	0	160	100.0%
7. Radioactive Waste Mngmt.	75	63	44	-19	-30.2%
Total DOE R&D	8,713	8,614	8,393	-221	-2.6%
Detail of DOE R&D:					
1. Energy Supply (does not include non-R&D components)					
Renewable Energy	224	247	230	-17	-7.0%
Electricity Transm. & Distrib.	71	91	72	-20	-21.5%
Nuclear Energy	87	85	95	10	11.8%
Total Energy Supply R&D	382	423	397	-27	-6.4%
2. Science (does not include non-R&D components)					
High-Energy Physics (HEP)					
Proton Accelerator-Based	383	401	387	-14	-3.5%
Electron Accelerator-Based	145	144	133	-11	-7.7%
Non-Accelerator Physics	47	47	39	-8	-17.8%
Theoretical Physics	49	49	49	0	0.2%
Advanced Tech. R&D	79	95	106	12	12.3%
Construction	12	1	0	-1	-100.0%
Total HEP	716	736	714	-23	-3.1%
Nuclear Physics					
Medium-Energy Nuclear Phys.	119	125	112	-13	-10.6%
Heavy Ion Nuclear Phys.	161	175	162	-13	-7.3%
Low Energy Nuclear Phys.	71	76	69	-7	-9.8%
Nuclear Theory	28	29	27	-3	-9.3%
Construction	0	0	2	2	--
Total Nuclear Physics	380	405	371	-34	-8.4%
Fusion Energy Sciences					
Science	143	155	143	-12	-7.9%
Facility Operations	86	90	128	38	41.8%
-ITER 3/	3	5	56	51	1021.9%
Technology	27	29	20	-9	-29.9%
Total Fusion	256	274	291	17	6.1%

(continued)

Table II-11. Department of Energy R&D

Table II-11 (continued). R&D in the Department of Energy
(budget authority in millions of dollars)

	FY 2004 Actual	FY 2005 Estimate	FY 2006 Budget	Change FY 05-06	
				Amount	Percent
Basic Energy Sciences (BES)					
Materials Sciences	559	635	746	111	17.5%
Chem. Scis., Geoscis., Energy	214	239	222	-18	-7.4%
Construction	219	230	178	-52	-22.6%
<i>-Spallation Neutron Source 2/</i>	142	113	149	36	31.5%
Total BES	991	1,105	1,146	41	3.7%
Advanced Scientific Computing Research (ASCR)					
Math., Info. and Compu. Sci.	194	232	207	-25	-10.9%
Laboratory Technology Res.	3	0	0	0	--
Total ASCR	197	232	207	-25	-10.9%
Biological and Environmental Research (BER)					
Life Sciences	200	203	204	1	0.6%
Climate Change Research	138	141	143	2	1.4%
Environmental Remediation	105	104	95	-10	-9.3%
Medical Apps./ Measure.	131	124	14	-110	-88.7%
Construction	0	10	0	-10	-100.0%
Total BER	574	582	456	-126	-21.7%
Small Bus. Innov. Research	115	0	0	0	--
Total Science R&D	3,229	3,334	3,184	-150	-4.5%
3. Fossil Energy R&D (does not include non-R&D components)					
Coal Research Initiative	369	273	286	13	4.9%
Other Power Systems	70	78	65	-13	-17.1%
Oil Technology	34	34	10	-24	-70.5%
Natural Gas Technology	42	45	10	-35	-77.7%
Cooperative R&D	8	8	3	-5	-63.8%
Other Fossil R&D and adjs.	24	10	8	-2	-18.6%
Total Fossil Energy R&D	547	448	382	-66	-14.7%
4. Energy Conservation	379	367	356	-11	-3.0%
5. Atomic Energy Defense Activities (does not include non-R&D components)					
National Nuclear Security Administration (NNSA)					
Weapons Activities					
Science Campaigns	259	276	262	-14	-5.1%
Adv. Simulation & Computing	715	697	661	-36	-5.2%

(continued)

Table II-11. Department of Energy R&D

Table II-11 (continued). R&D in the Department of Energy
(budget authority in millions of dollars)

	FY 2004 Actual	FY 2005 Estimate	FY 2006 Budget	Change FY 05-06 Amount	Percent
Inertial Confinement Fusion	512	536	460	-75	-14.1%
All Other Weapons R&D	1,700	1,575	1,557	-19	-1.2%
Total Weapons Acts. R&D	3,186	3,084	2,940	-144	-4.7%
Nonproliferation & Verification	226	224	272	48	21.4%
Naval Reactors	735	772	756	-16	-2.1%
Total NNSA R&D	4,147	4,080	3,968	-112	-2.8%
Environmental Management	43	56	61	5	8.9%
Other AEDA R&D	8	2	2	0	0.0%
Total Atomic Defense R&D	4,198	4,138	4,031	-107	-2.6%
6. Clean Coal Technology 1/	-98	-160	0	160	-100.0%
7. Radioactive Waste Mngmt.	75	63	44	-19	-30.2%
Total DOE R&D	8,713	8,614	8,393	-221	-2.6%
Conduct of R&D	7,465	7,477	7,301	-176	-2.3%
R&D Facilities	1,248	1,137	1,092	-45	-4.0%
DOE R&D by Function:					
Defense	4,198	4,138	4,031	-107	-2.6%
General Science	3,229	3,334	3,184	-150	-4.5%
Energy	1,285	1,141	1,179	37	3.2%

Source: DOE budget justification, OMB data for R&D, and agency supporting documents.
Some data adjusted by AAAS based on DOE agency budget documents.

- 1/ Negative budget authority because of rescissions and deferrals of previously appropriated funds. Coal research is now funded in the Fossil Energy program.
- 2/ Operations and construction costs. Operations costs are in Materials Sciences.
- 3/ International Thermonuclear Experimental Reactor. Most costs are in Facility Operations.

Please see Chapter 9 for a discussion of DOE R&D.

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Table II-11. Department of Energy R&D

Department of Energy Budget (discretionary budget authority in millions of dollars)

	FY 2004 Actual	FY 2005 Estimate	FY 2006 Budget	Change FY 05-06	
				Amount	Percent
DOE Defense Programs:					
National Nuclear Security Administration (NNSA):					
Weapons Activities	6,647	6,583	6,630	47	0.7%
Other NNSA Activities	2,283	2,581	2,767	187	7.2%
Total NNSA	8,930	9,164	9,397	233	2.5%
Defense Env. Activities	6,328	6,572	6,015	-557	-8.5%
Nuclear Waste & Other Defense	1,064	902	987	86	9.5%
Total DOE Defense	16,306	16,637	16,400	-238	-1.4%
Science	3,536	3,600	3,463	-137	-3.8%
Energy Supply	795	932	903	-30	-3.2%
Fossil Energy	659	572	491	-80	-14.1%
Energy Conservation	868	868	847	-21	-2.5%
Other Energy Programs	517	650	931	281	43.2%
Non-defense Environmental Mgmt	308	289	178	-111	-38.6%
Power Marketing Administrations	213	209	57	-152	-72.6%
Departmental Administration & IG	149	160	173	13	8.0%
Total DOE Budget	23,351	23,918	23,443	-475	-2.0%

Source: Department of Energy budget justification.

DOE appropriations only (discretionary), excluding offsets.

Includes R&D and non-R&D components.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

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