



December 6, 2004 –  
Final FY 2005 DOE Appropriations

## DOE Wins Modest Increases in 2005

### Highlights

- **The Department of Energy's (DOE) Office of Science (OS) emerged from the FY 2005 budget process a winner with \$3.3 billion for its R&D programs, 4.3 percent more than last year** (see Table). DOE OS programs in high energy physics, fusion research, nuclear physics, computing research, and basic energy sciences all receive increases.

- **Total DOE R&D rises 1.7 percent to \$9.0 billion.**

- DOE's energy R&D declines 2.6 percent to \$1.3 billion. Congress rejected a proposed boost to \$237 million for the FutureGen program to develop a next-generation hydrogen power plant and left funding at \$18 million.

- DOE's defense-related R&D increases a modest 1.2 percent to \$4.3 billion. Congress rejected DOE requests for \$36 million in new funds to develop a new generation of nuclear weapons, including 'bunker buster' tactical nuclear weapons.

### DOE R&D in FY 2005 Final Appropriations

On November 20, Congress came to an agreement on an FY 2005 omnibus appropriations bill (HR 4818), incorporating the final versions of the FY 2005 Energy-Water and Interior appropriations bills, which together fund the Department of Energy (DOE). The House is expected to give final approval on December 6, and President Bush is expected to sign the bill into law on December 8. The omnibus bill keeps funding for domestic programs flat in FY 2005; the domestic side of the DOE budget is caught in the squeeze, especially after factoring in a 0.80 percent across-the-board cut for most programs, but DOE overall does well because the bulk of its budget is defense spending, which increases substantially. (All figures in this analysis reflect the across-the-board cut.) DOE is especially lucky because there was some doubt until the last minute whether the Energy-Water bill would make it into the omnibus bill; the Senate had never even drafted its version of it, and the entire bill was stuck in a protracted dispute over funding the Yucca Mountain waste depository. But just two days before the omnibus was finalized, Energy-Water bill was rolled into the bill.

The omnibus bill provides **\$9.0 billion for DOE's R&D programs in FY 2005, \$152 million or 1.7 percent more than FY 2004**, an increase just ahead of the 1.25 percent expected inflation rate (see Table). Although DOE's science and defense-related R&D activities receive modest increases, funding for DOE's energy R&D falls. (For details of R&D in the FY 2005 request, please see Chapter 9 of *AAAS Report XXIX: R&D FY 2005*.)

The total FY 2005 DOE budget is \$24.4 billion, an increase of \$582 million or 2.4 percent that is well below the Administration request, primarily because Congress did not authorize a \$749 million proposal for expanded Yucca Mountain activities financed through a new trust fund transfer, and had to find Yucca Mountain dollars from other sources, including transfers from other DOE programs (see Table). More than two-thirds of the DOE budget (\$16.6 billion) goes to defense-related activities involving the U.S. nuclear weapons stockpile and related environmental clean-up costs, including defense-related R&D to support these activities.

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## R&D in the DOE Office of Science (OS)

R&D in DOE's **Office of Science (OS) programs emerged a winner in the omnibus bill, with increases going to most OS programs.** Although the Administration proposed declining funding at \$3.2 billion for the fourth year in a row, Congress added \$152 million to the request for a total of \$3.3 billion in R&D for FY 2005, a 4.3 percent boost compared to last year. The final appropriation contains \$78 million in congressionally designated projects (earmarks) that were not in the request, but this compares to \$95 million in FY 2004 earmarks, so the Office of Science actually has even more funds to devote to its core R&D programs in FY 2005.

The funding boost should allow major OS research programs to increase operating time and user support at scientific user facilities. 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 have squeezed operating time at these facilities. Funding for the largest OS account, Basic Energy Sciences, increases \$96 million to \$1.1 billion, at the same time that construction costs of the Spallation Neutron Source, a new large-scale facility in Tennessee, decline. As a result, BES support of research grants and user time at existing facilities should increase substantially in FY 2005, especially in the area of nanoscale science.

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. Both physics programs increase slightly in FY 2005. It is also a leading supporter of biological sciences, environmental sciences, computing sciences, and fusion research.

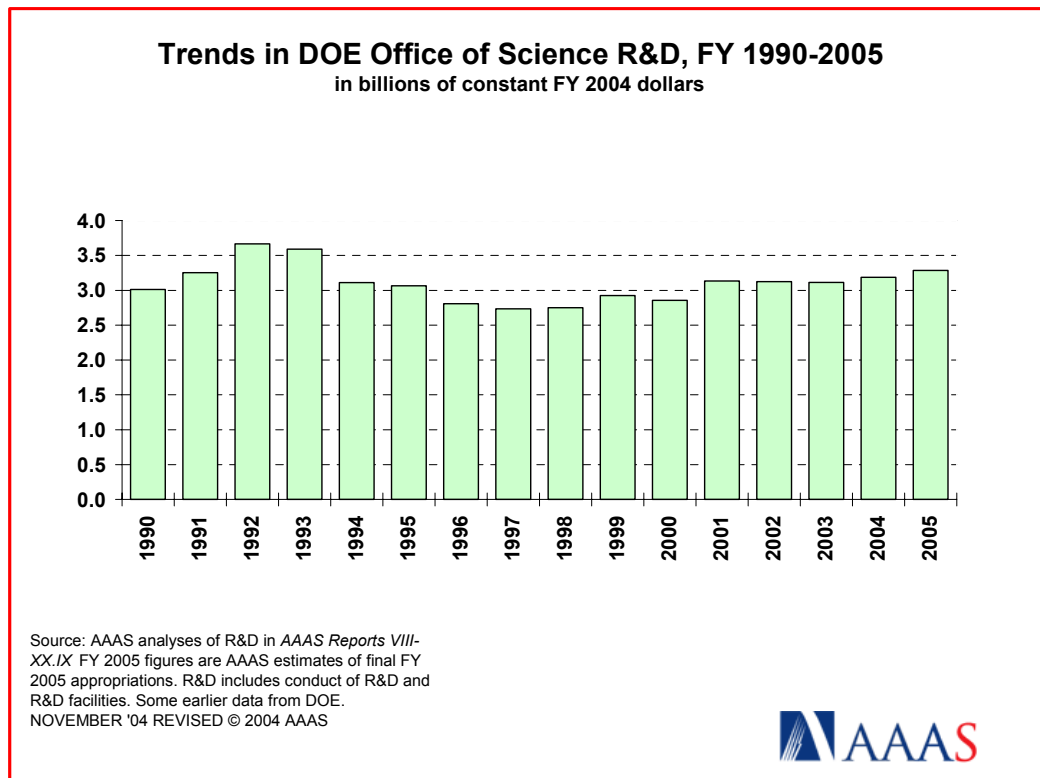


Figure 1. (click on the image for PDF)

**Congress provides additional funds to the Fusion Energy Sciences program to ensure that U.S. participation in an international fusion project will not crowd out domestic research.** The Fusion appropriation of \$274 million is \$11 million more than last year and \$10 million more than the request. The additional funds would go to increase user time at domestic fusion experimental facilities. Congress also

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urges DOE to support additional domestic fusion research with funds freed up by delays in the International Thermonuclear Experimental Reactor (ITER). 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; a year after a deadline to pick a site has come and gone, the six partners are still deadlocked.

**The largest Office of Science increase goes to Advanced Scientific Computing Research (ASCR),** whose funding jumps 14.9 percent to \$232 million in contrast to a flat request. The additional funds would help develop hardware, software, and algorithms necessary for world-leading research supercomputing capabilities. There has been increasing congressional concern that the U.S. is losing its lead in high-performance research computing, especially to Japan. Just a few weeks ago, the President signed into law an authorization bill (HR 4516) that would give a higher profile to DOE's high performance computing activities and would establish a specific DOE R&D program in ASCR to develop more advanced research supercomputing user facilities.

**The Biological and Environmental Research (BER) account declines 3.0 percent to \$572 million in the omnibus bill.** The BER account is the traditional home of earmarks in the OS account, totaling \$95 million in FY 2004 for R&D earmarks and a reduced but still formidable list of \$78 million for 103 projects in FY 2005. The \$17 million drop in earmarks should allow core BER funding to remain stable to support research in genomics, medical applications, biological imaging, climate change science, and environmental remediation.

**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 2005 increase represents an increase in inflation-adjusted terms to the highest level since 1993.

### **DOE Energy and Defense R&D Programs**

**Congress approved a cut to DOE's energy-related R&D overall, but big increases for selected energy programs.** The overall Solar and Renewables R&D program increases to \$325 million in FY 2005; Congress agreed to the Administration's requested increase for hydrogen-related research to \$95 million. Nuclear energy R&D surges 31 percent to \$171 million in contrast to a requested cut. Earlier in the year, the House criticized DOE for designating the newly consolidated Idaho National Laboratory (INL) as the home of nuclear energy R&D, but proposing cuts in nuclear energy R&D there; the final bill assures INL increased funding for its first full year of operation, including funds to develop technologies needed for a next-generation nuclear reactor. Electricity transmission and distribution R&D also receives a large boost (up 32 percent), to \$91 million.

Fossil Energy R&D falls 18.9 percent to \$377 million because Congress denied the Administration's \$237 million request for the FutureGen program, offering only \$18 million. FutureGen is an initiative aimed at building an integrated, near-emission-free electricity and hydrogen production plant and began with \$9 million in FY 2004. Congress used some of the funds freed up by the FutureGen reductions to boost funding for other programs, but not enough to keep overall Fossil Energy R&D from falling steeply. The separate Clean Coal power initiative received \$50 million, far below the \$170 million FY 2004 funding level. But Advanced Research increases to \$43 million, a small boost instead of the 20 percent cuts requested by the President, and distributed generation systems aimed at fuel cell research received \$78 million, more than triple the requested amount.

DOE has responsibility for managing and disposing of the nation's spent nuclear fuel and high-level radioactive waste, both civilian and military. In past years, Waste Management R&D represented a small part of the DOE's portfolio. However, as the Yucca Mountain long-term, high-level nuclear waste repository moves forward after receiving congressional and White House approvals a year ago, the FY 2005 request would have quadrupled the budget for radioactive waste management R&D to \$275 million, funded by the proposed transfer of nuclear power funds out of a trust fund. In last-minute negotiations over the omnibus bill, Congress did not agree to the trust fund transfer and had to find Yucca Mountain funding

from other DOE programs, resulting in a boost to Yucca Mountain but not as high as requested. Yucca Mountain-related R&D received \$127 million, half the request but nearly double last year's funding level.

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 has grown substantially in recent years in lockstep with rapid growth in overall defense spending, from \$2.4 billion in FY 2001 to \$3.2 billion last year, but slows down to a 0.9 percent increase to \$3.2 billion in the FY 2005 budget. Within the overall portfolio, Inertial Confinement Fusion R&D funding rises 4.4 percent to \$537 million, including \$129 million for continued construction of the National Ignition Facility at the Lawrence Livermore National Laboratory in California. DOE's considerable investments in research computing on the defense side of the budget continue at \$698 million, down 3.2 percent from last year but still nearly triple the ASCR investment on the nondefense side.

This year, there was again considerable controversy over the **Bush Administration's proposal to initiate research on a new generation of nuclear weapons**, including the Robust Nuclear Earth Penetrator (RNEP) project (nicknamed a 'bunker buster' bomb) and other tactical or 'low-yield' nuclear weapons. The President requested \$28 million in FY 2005 for continued R&D on the RNEP project and \$9 million for similar concept studies, but the omnibus bill specifically zeroes out funding for both programs. Last year, President Bush signed into law a defense authorization bill which repealed the longstanding U.S. prohibition on research and development of low-yield nuclear weapons, thus allowing this research program to take place, but prohibited DOE from entering the development phase of the RNEP or other tactical nuclear weapons unless it receives explicit authorization from Congress. 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 its budget over the next five years, an investment more than sufficient to move the program well into design and development toward eventual production.

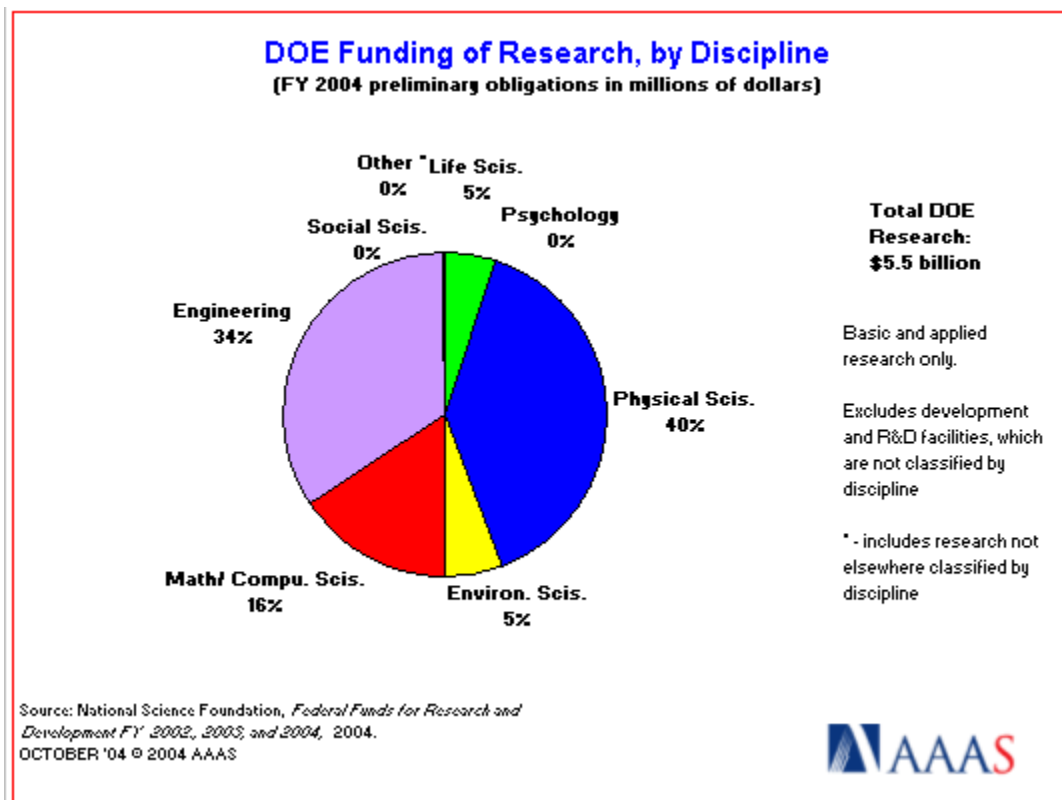


Figure 2. (click on the image for PDF)

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## Likely Impacts of the DOE FY 2005 Budget

DOE's FY 2005 budget should allow for a modest expansion of the department's research efforts. As Figure 2 suggests, roughly two-thirds of DOE's R&D portfolio goes to basic and applied research, with the remainder going to development and R&D facilities. More than a third of this research portfolio goes to support of the physical sciences, a third to engineering research, and the remainder to the computer sciences, mathematics, and other disciplines.

This DOE support for the physical sciences is crucial to the health of the U.S. physical sciences enterprise. DOE support is the largest single federal agency sponsor for the physical sciences, as shown in Figure 3. DOE funds more than 40 percent of all federal support for the physical sciences, and in physics research it is responsible for nearly two-thirds of all federal support. In addition to the overwhelming DOE role in research funding, DOE also funds construction and maintenance of large physics facilities at its national laboratories such as Argonne National Laboratory and in Europe such as the Large Hadron Collider which are used by physicists and other researchers for their experiments.

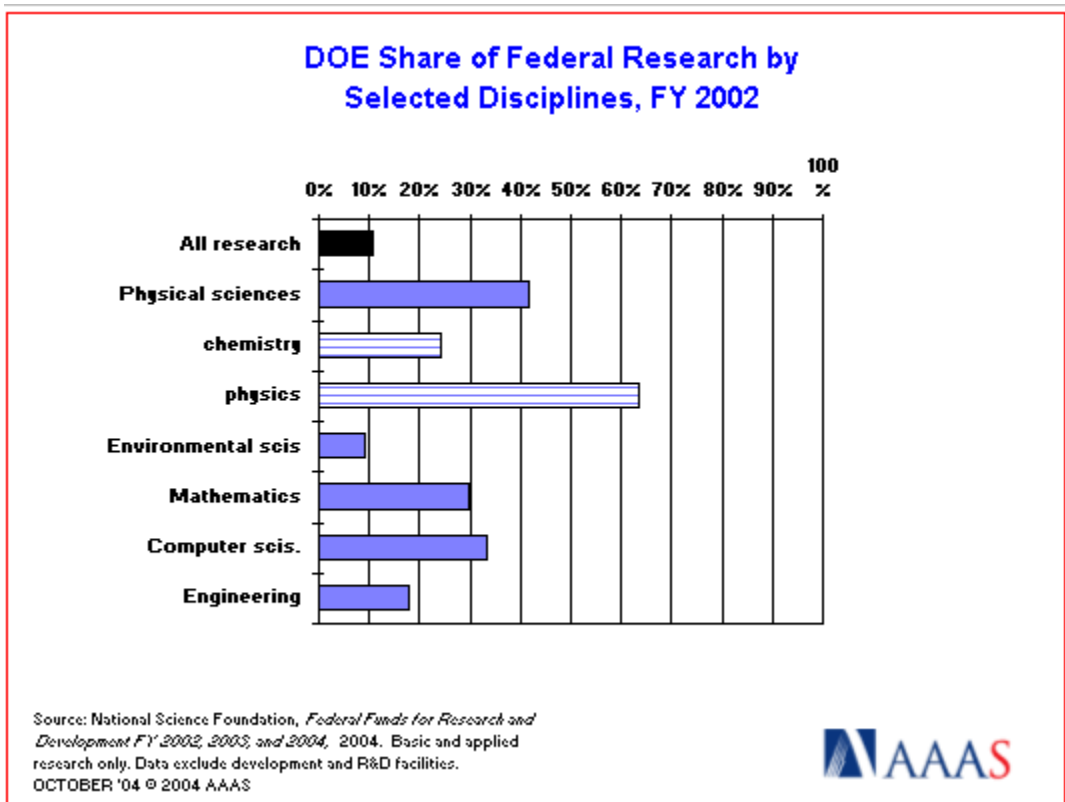


Figure 3. (click on the image for PDF)

Because of recent stagnation in the Office of Science budget (see Figure 1), DOE support for physical sciences research in particular has declined in recent years, peaking in FY 1994 and declining by nearly 20 percent since then from \$2.5 billion a year to \$2.1 billion in FY 2004. While the modest FY 2005 increase will not reverse these cuts, the FY 2005 DOE budget should at least allow the department to keep its support for physical sciences research level with last year. Similarly, DOE support of the environmental sciences and life sciences, primarily in the OS BER program, has also declined since the 1990s.

In recent years, the growth areas for DOE's research portfolio have been in the computer sciences and engineering, which now collectively make up half the DOE research portfolio. This recent growth reflects funding increases in DOE defense programs supporting the nuclear stockpile stewardship mission such as Advanced Simulation and Computing and Inertial Confinement Fusion, along with more modest increases

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in their ASCR and Fusion Energy Sciences non-defense counterparts. The FY 2005 budget promises increases in these programs, which should translate into modest increases in engineering and a large increase in computer sciences support from DOE.

Nearly two-thirds (63 percent) of DOE's is performed in DOE's network of national laboratories, which are government owned but operated by contractors. These are split between the three primarily defense laboratories (Los Alamos, Sandia, and Lawrence Livermore) which receive the bulk of their funding from the Weapons Activities account, and the multi-program civilian laboratories (such as Argonne, Brookhaven, and Oak Ridge) which receive a mix of Office of Science, energy, and defense funding. Universities and colleges receive less than 10 percent of the DOE R&D portfolio, but university researchers benefit from being able to use the scientific user facilities located at the national laboratories for their experiments. Another tenth of the DOE R&D portfolio is performed at DOE federal laboratories, which are similar to the national laboratories except that they are fully owned and operated by the federal government. Finally, 16 percent of the DOE R&D portfolio funds work in private industry, primarily in the energy R&D programs but also in the defense programs.

Because DOE's R&D performance is dominated by the national laboratories, a majority of DOE's R&D is performed in just the three states of New Mexico (Los Alamos, Sandia), California (Lawrence Livermore, Lawrence Berkeley), and Tennessee (Oak Ridge), with Illinois (Argonne, FermiLab) and New York (Brookhaven) the next largest recipient states for DOE R&D funds.

### **Next Steps**

President Bush is likely to sign the omnibus bill into law on December 8, thus finalizing DOE's FY 2005 budget.

(This analysis is one of a series of AAAS R&D Funding Updates on the FY 2005 appropriations process. This analysis includes information on R&D in final FY 2005 appropriations for the Department of Energy. The complete series of AAAS R&D Funding Updates, including continually updated analyses of R&D by agency in FY 2005 appropriations, is available on the AAAS R&D Web Site (<http://www.aaas.org/spp/rd>) in the "FY 2005 R&D" or the "What's New" sections.)

- December 6, 2004  
AAAS R&D Budget and Policy Program  
(202) 326-6607  
e-mail: [science\\_policy@aaas.org](mailto:science_policy@aaas.org)  
AAAS R&D Web site: <http://www.aaas.org/spp/rd>



Table. DOE R&amp;D in FY 2005 Final Appropriations

**Table. Department of Energy  
Final Congressional Action on R&D in the FY 2005 Budget  
(budget authority in millions of dollars)**

	FY 2004 Estimate	FY 2005 Request	FY 2005 Approved	House-Senate Conference		Chg. from FY 2004 Amount	Chg. from FY 2004 Percent
				Chg. from Request Amount	Chg. from Request Percent		
DOE Appropriations Containing R&D:							
1. Energy Supply R&D	519	454	<b>587</b>	133	29.3%	68	13.0%
2. Fossil Energy R&D	465	441	<b>377</b>	-64	-14.6%	-88	-18.9%
3. Energy Conservation	419	345	<b>408</b>	63	18.3%	-11	-2.6%
4. Science	3,186	3,172	<b>3,324</b>	152	4.8%	138	4.3%
5. Atomic Energy Defense Activities	4,244	4,333	<b>4,293</b>	-40	-0.9%	49	1.2%
6. Clean Coal Technology <sup>1</sup>	-98	-140	<b>-160</b>	-20	14.3%	-62	63.3%
7. Radioactive Waste Management	69	275	<b>127</b>	-149	-54.0%	58	83.3%
<b>Total DOE R&amp;D</b>	<b>8,804</b>	<b>8,880</b>	<b>8,956</b>	<b>76</b>	<b>0.9%</b>	<b>152</b>	<b>1.7%</b>
Detail of selected appropriations:							
1. Energy Supply R&D							
Solar and Renewables	320	282	<b>325</b>	43	15.3%	5	1.6%
Electricity Transmission & Distrib. <sup>3</sup>	69	76	<b>91</b>	16	20.8%	22	31.6%
Nuclear Energy	130	96	<b>171</b>	74	77.2%	41	31.3%
<b>TOTAL Energy Supply</b>	<b>519</b>	<b>454</b>	<b>587</b>	<b>133</b>	<b>29.3%</b>	<b>68</b>	<b>13.0%</b>
4. Science <sup>2</sup>							
High Energy Physics	734	737	<b>736</b>	-1	-0.1%	3	0.4%
Nuclear Physics	390	401	<b>405</b>	4	0.9%	15	3.9%
Fusion Energy Sciences	263	264	<b>274</b>	10	3.7%	11	4.3%
Basic Energy Sciences	1,008	1,064	<b>1,105</b>	41	3.9%	96	9.6%
(Spallation Neutron Source)	227	129	<b>129</b>	0	0.0%	-98	-43.2%
Adv. Scientific Computing Res.	202	204	<b>232</b>	28	13.8%	30	14.9%
Biological and Environmental Res.	590	502	<b>572</b>	70	14.0%	-18	-3.0%
<b>TOTAL Science <sup>2</sup></b>	<b>3,186</b>	<b>3,172</b>	<b>3,324</b>	<b>152</b>	<b>4.8%</b>	<b>138</b>	<b>4.3%</b>
5. Atomic Energy Defense Activities							
<b>National Nuclear Security Administration (NNSA)</b>							
Naval Reactors	738	769	<b>773</b>	4	0.5%	35	4.7%
Weapons Activities	3,184	3,261	<b>3,214</b>	-47	-1.4%	30	0.9%
(Science Campaigns)	249	301	<b>277</b>	-24	-7.9%	28	11.3%
(Adv. Simulation and Computing)	721	741	<b>698</b>	-43	-5.8%	-23	-3.2%
(Inertial Confinement Fusion)	514	492	<b>537</b>	45	9.1%	22	4.4%
-- (Nat'l Ignition Facility Const.)	149	130	<b>129</b>	-1	-0.8%	-20	-13.5%
(All Other Weapons Acts. R&D)	1,699	1,727	<b>1,702</b>	-25	-1.4%	3	0.2%
Nonproliferation & Verification R&D	234	218	<b>222</b>	4	1.8%	-12	-5.2%
<b>Total NNSA R&amp;D</b>	<b>4,156</b>	<b>4,248</b>	<b>4,209</b>	<b>-39</b>	<b>-0.9%</b>	<b>53</b>	<b>1.3%</b>
Environmental Management	60	56	<b>56</b>	0	-0.8%	-4	-7.4%
Other AEDA R&D	28	29	<b>29</b>	0	0.0%	1	3.6%
<b>TOTAL Atomic Defense R&amp;D</b>	<b>4,244</b>	<b>4,333</b>	<b>4,293</b>	<b>-40</b>	<b>-0.9%</b>	<b>49</b>	<b>1.2%</b>

(continued)

Table. DOE R&amp;D in FY 2005 Final Appropriations

## DOE R&amp;D by Budget Function:

Defense	4,244	4,333	<b>4,293</b>	-40	-0.9%	49	1.2%
General Science	3,186	3,172	<b>3,324</b>	152	4.8%	138	4.3%
Energy	1,374	1,375	<b>1,339</b>	-37	-2.7%	-36	-2.6%

AAAS estimates based on FY 2004 and FY 2005 appropriations bills. Includes conduct of R&D and R&D facilities.

FY 2004 and FY 2005 request figures based on OMB R&D data and supplemental agency budget data.

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

<sup>1</sup> Funded from advance appropriations in previous years. Does not include deferrals of previously appropriated funds.

<sup>2</sup> Does not include program direction, waste management, and other non-R&D costs.

<sup>3</sup> New account. AAAS estimates of R&D.

**FY 2005 Approved figures adjusted to reflect across-the-board reductions in the FY 2005 omnibus bill.**

**November 24, 2004 - AAAS estimates of final FY 2005 appropriations bills.**

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

	FY 2004 Estimate	FY 2005 Request	FY 2005 Approved	House-Senate Conference			
				Chg. from Request Amount	Chg. from Request Percent	Chg. from FY 2004 Amount	Chg. from FY 2004 Percent
Weapons Activities (NNSA)	6,234	6,568	<b>6,177</b>	-392	-6.0%	-57	-0.9%
Other NNSA Activities	2,433	2,480	<b>2,564</b>	84	3.4%	131	5.4%
Total NNSA	8,666	9,049	<b>8,740</b>	-308	-3.4%	74	0.9%
Defense Environmental Activities	6,574	6,953	<b>6,978</b>	25	0.4%	404	6.1%
Nuclear Waste and Other Defense	1,058	795	<b>916</b>	122	15.3%	-141	-13.4%
Total DOE defense	16,298	16,797	<b>16,635</b>	-162	-1.0%	337	2.1%
Science	3,500	3,432	<b>3,600</b>	168	4.9%	100	2.8%
Energy Supply	789	835	<b>939</b>	103	12.4%	150	19.0%
Fossil Energy	673	636	<b>572</b>	-64	-10.1%	-101	-15.0%
Energy Conservation	878	876	<b>867</b>	-9	-1.0%	-11	-1.3%
Other Energy Programs	817	1,427	<b>932</b>	-495	-34.7%	115	14.1%
Nondefense Environmental Mngmt.	469	443	<b>440</b>	-4	-0.8%	-29	-6.2%
Power Marketing Administrations	213	210	<b>209</b>	-2	-0.8%	-4	-2.0%
Departmental Administration	133	164	<b>159</b>	-5	-3.3%	26	19.3%
<b>Total DOE Budget</b>	<b>23,769</b>	<b>24,820</b>	<b>24,351</b>	<b>-469</b>	<b>-1.9%</b>	<b>582</b>	<b>2.4%</b>

Source: Department of Energy budget justification and FY 2005 appropriations bills.

DOE appropriations only (does not include offsets and other mandatory).

**FY 2005 Approved figures adjusted to reflect across-the-board reductions in the FY 2005 omnibus bill.**

**November 24, 2004 - AAAS estimates of final FY 2005 appropriations bills.**