

Senate Gives DOE \$10 Billion for R&D

AAAS R&D Funding Update on DOE R&D in FY 2008 Senate Appropriations

Highlights

- Building on a requested increase and a generous House appropriation, the Senate would go even higher with a **\$10.0 billion appropriation for the Department of Energy's (DOE) R&D portfolio in FY 2008, an increase of 14.5 percent or \$1.3 billion** (see Table).

- **The Senate would give the Department of Energy's (DOE) Office of Science an 18 percent increase for its R&D to \$4.1 billion, adding to a substantial proposed increase as part of the American Competitiveness Initiative (ACI).**

- DOE's energy-related R&D would total \$2.0 billion in the Senate plan, an enormous 29.1 percent increase, in sharp contrast to a requested cut. Both the House and the Senate would go along with proposed increases for R&D investments in renewable energy technologies such as hydrogen, biomass, and solar energy, but would also revive geothermal and hydropower R&D programs proposed for elimination. In fossil fuels, the Senate would add to a large request for coal R&D, including a one-third boost for carbon sequestration R&D, but would also save gas and oil technology R&D programs from elimination and would add congressionally designated projects after a one-year moratorium. The Senate would also boost energy conservation programs proposed for cuts.

- Although the House would eliminate funding for the Reliable Replacement Warhead (RRW), the Senate would keep it going with \$66 million, nearly double current funding. In addition to a modest increase in nuclear weapons R&D, the Senate would join the House in giving substantial increases for nonproliferation R&D and environmental cleanup technology development, resulting in a total DOE defense R&D investment of \$3.9 billion, up 5.1 percent.

DOE R&D in FY 2008 Senate Appropriations

On June 28, the Senate Appropriations Committee approved its version of the FY 2008 Energy-Water appropriations bill (S 1751) providing funding for Department of Energy (DOE) programs, a few weeks after its House counterpart approved a House version. The full House and Senate are expected to debate their respective versions later this month. The Senate bill contains \$32 billion in 2008 discretionary spending for DOE, the Corps of Engineers, and other programs, \$2.0 billion more than the current year and \$1.8 billion more than the President's request. DOE would receive a total budget of \$25.9 billion, \$1.7 billion or 6.9 percent more than the current year and \$1.1 billion above the President's request (see Table).

DOE was already in line for a large R&D funding increase in DOE's request, but the House and now the Senate would add even more money to its science programs and would also add money for renewable energy R&D programs. In the Senate appropriation, **DOE R&D would reach \$10 billion for the first time, a substantial \$1.3 billion or 14.5 percent more than this year**, and \$761 million more than DOE's request. There would be large increases for all three DOE mission areas of science, energy, and defense.

President Bush's American Competitiveness Initiative (ACI) and Advanced Energy Initiative (AEI), both set for their second years in 2008, have made the Department of Energy's (DOE) R&D programs a high priority within an increasingly tight domestic budget. (For details of DOE R&D in the FY 2008 budget request, see Chapter 8 of *AAAS Report XXXII: R&D FY 2008* or the March 21 AAAS R&D Funding Update on DOE. For details of House appropriations for DOE, see the June 13 R&D Funding Update.)

DOE's Office of Science is the largest federal sponsor of physical sciences research and is thus one of three federal agencies (the other two are the National Science Foundation and the National Institute of Standards and Technology laboratories) that would receive substantial increases to fulfill the ACI's goal of increasing federal investments in basic physical sciences research. DOE's energy R&D portfolio funds R&D on a variety of topics, including renewable energy R&D on the Administration priorities of hydrogen, solar power, and biomass, all of which received substantial increases in 2007. The Democratic majority in the 110th Congress has already signaled its support for these two Administration priorities, both rhetorically (under different labels) and financially in wrapping up 2007 appropriations earlier this year with increases for these programs.

Congress again steps up to the plate for these programs in the 2008 appropriations process. First, the House fully funded a requested 15 percent increase for the Office of Science but added even more money for biological and environmental programs for a 16.8 percent increase. In energy, the House chiseled the DOE request for hydrogen R&D slightly, but added significantly to the requests for every other energy R&D program including several that had been proposed for elimination. Now the Senate would go above and beyond the House appropriation, both for the Office of Science (up 18 percent) and for energy R&D programs (up a dramatic 29 percent).

R&D in the DOE Office of Science

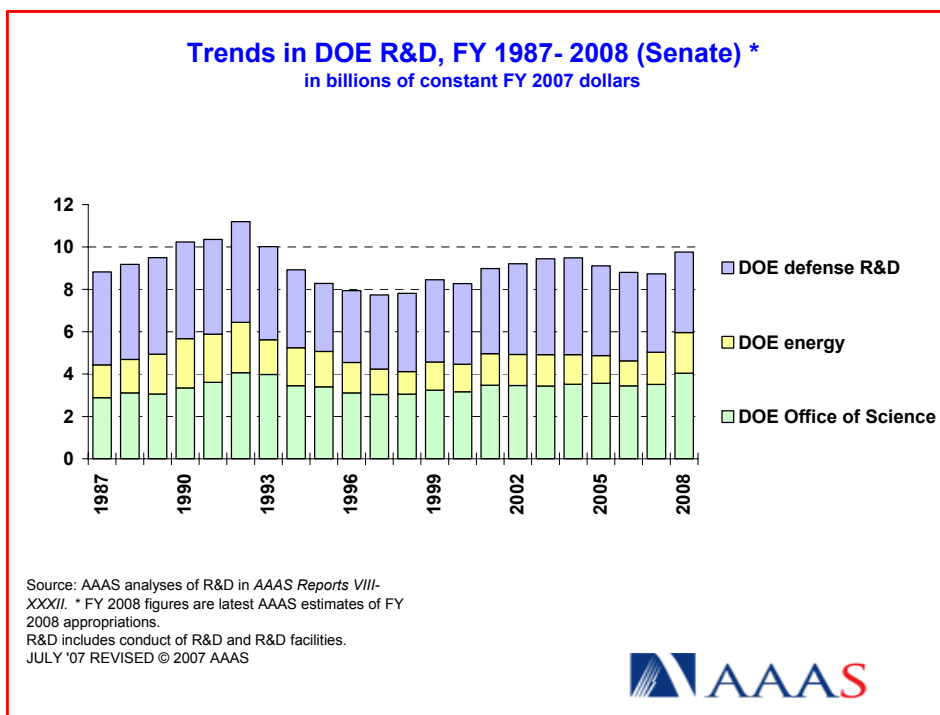


Figure 1. (click on the image for PDF)

DOE's Office of Science, in its various incarnations over the decades, has long been the dominant federal sponsor of physical sciences research, and is also an important supporter of computer sciences, mathematics, environmental sciences, materials research, nanotechnology, and engineering; the Bush Administration's and now Congress' push to boost the Science budget would pay off for all Science research areas. Last year, DOE requested a 14 percent increase for Science funding, and ended up with 5 percent in February's final 2007 appropriations. To catch up with the ACI's funding trajectory, the 2008 request for the total Office of Science budget would be a 16 percent boost to \$4.4 billion, consistent with a plan to double the budget between 2006 and 2016. More than 90 percent of the Science budget goes to R&D activities; Science R&D would gain 15.4 percent in the FY 2008 request to \$4.1 billion; the House would add \$50 million in R&D funding on top of that for a 16.8 percent increase, while **the Senate would**

add \$89 million to the request for a total of \$4.1 billion, an 18 percent boost (see Table). The total Science budget would climb 18.4 percent to \$4.5 billion, including additions for non-R&D facilities maintenance costs. The large 2008 increase following 2007's increase would mark a departure from the flat or declining funding trends of earlier years (see Figure 1), and in real terms would bring Science funding very close to its all-time high of 1992, before the Superconducting Super Collider was canceled.

Funding for every Science program would increase substantially for the second year in a row, including a 34 percent increase for fusion research, and roughly 20 percent boosts for basic energy sciences, computing research, and biological and environmental research (see Figure 2). Most Science programs would reach new highs in the 2008 House and Senate appropriations, although the two physics programs would barely recover lost ground from recent budget cuts, to remain at the flat funding levels of earlier this decade.

The Office of Science supports cutting-edge research through a mix of laboratory research at DOE's national laboratories, university-based research, and the construction and operation of large scientific user facilities that can be used by external researchers for their experiments. Roughly half of Science R&D funding goes to operate and construct facilities, while the other half supports research, mostly at DOE laboratories but a large portion at universities. The laboratory research and large facilities are housed primarily at ten Science laboratories that are federally owned and contractor operated, such as the Oak Ridge National Laboratory in Tennessee, Brookhaven National Laboratory in New York, and Argonne National Laboratory in Illinois. After several years in which tight budgets have forced the cancellation of planned facilities, dramatic reductions in facility operating times, and reductions in external research support, the 2007 increase and the even larger 2008 increase would allow the Office to open new facilities and begin planning for newer ones, expand user times at existing facilities, and boost external research.

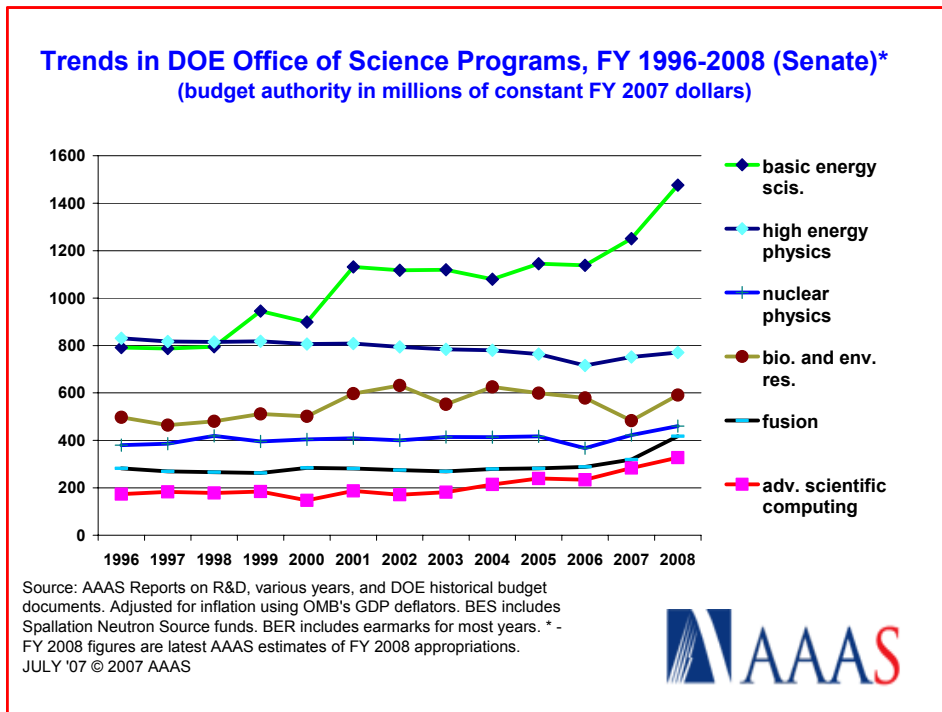


Figure 2. (click on the image for PDF)

The Senate would agree to the requests for most Science programs but would add \$73 million on top of a requested increase for Biological and Environmental Research (BER) for a 25 percent boost to \$605 million. \$49 million of the Senate add-on would go to R&D earmarks, congressionally designated performer-specific projects making a reappearance in 2008 appropriations bills after a one-year moratorium on domestic earmarks in 2007. Another \$20 million on top of the request would go to nuclear

medicine research, instead of the zero funding requested.

Basic Energy Sciences (BES) has fared the best among Science program areas in recent years, and would continue to do well with a 21.0 percent increase to \$1.5 billion in DOE's request, the House appropriation, and now the Senate (see Figure 2). The Senate's extra dollars above the request would go mostly to double funding for DOE's EPSCoR (Experimental Program to Stimulate Competitive Research) program. Construction funding for the Linac Coherent Light Source, the Advanced Light Source, and planning for the National Synchrotron Light Source II would keep the program busy with a full plate of future facilities, even as the Spallation Neutron Source (SNS; due to open this year), four light sources, five nanoscale research centers would keep current operations at a high level. BES would also fund more basic research on hydrogen, solar, and biomass topics as a complement to the more applied energy research programs elsewhere in DOE.

High-performance computing research in the Advanced Scientific Computing Research (ASCR) program would be in for a 18 percent boost to \$335 million to expand the availability of high-performance computing capacity that researchers can use for their experiments. In fusion, **the multinational International Thermonuclear Experimental Reactor (ITER) would continue to expand with full U.S. participation** through the Fusion Energy Sciences program, up 34 percent or \$109 million to \$428 million in 2008. ITER funding climbed from \$19 million last year to \$60 million in 2007, and would soar to \$160 million next year. The large Fusion increase would enable ITER funding to climb and still leave enough for a slight increase for domestic fusion activities in New Jersey, California, and Massachusetts.

The High Energy Physics (HEP) program, which funds basic research on the nature of matter and energy, would get a 5.0 percent increase to \$789 million (see Table). The program does most of its work at three facilities located at two DOE labs (Fermilab in Illinois and the Stanford Linear Accelerator Center in California) and also cooperates in the international Large Hadron Collider (LHC) in Switzerland, which transitions from fabrication toward operation later this year. Some funding pressure would be relieved by a planned shift in operating funds for the B-factory in California from HEP to the BES program. The increase, along with the money freed up from the transfer, should allow the program to sustain facility operating times, to boost research funding, and to sustain a \$60 million research investment in the International Linear Collider, the next big international high-energy physics project after the LHC. The \$7 million above the request for HP would go to the Joint Dark Energy Mission (JDEM), a proposed international and possibly multi-agency (with NASA) mission to search for dark energy, and would send a signal to DOE that it should move forward with the mission. The Nuclear Physics (NP) program would get an 11.5 percent increase to \$471 million. NP seeks to understand the structure and interactions of subatomic particles, and supports four user facilities.

DOE Energy R&D Programs

Last year, President Bush proposed dramatic funding boosts for selected alternative energy R&D programs as part of his Advanced Energy Initiative (ACI) to reduce U.S. dependence on Middle East oil; Congress unexpectedly added even more money to bring DOE energy R&D to \$1.5 billion in 2007, a surprising 32 percent boost over the year before. The 2008 request retreats from the 2007 highs in most areas down to \$1.4 billion, but the House would barrel ahead with a \$1.8 billion total for energy R&D in 2008 and now the Senate would go even higher with \$2.0 billion, 29 percent more than the current year. Both the House and Senate Energy-Water bills make a point of decrying a decades-long decline in federal energy R&D investments down to one-fifth to one-third of peak 1980 funding levels, and points to the 2007 and 2008 pending increases as the first steps toward restoring federal investments in energy R&D. If the Senate appropriation is enacted, then DOE energy R&D would climb 70 percent in just two years, although funding levels would still remain below peak investments in the late 1970s.

While the Administration's energy R&D increases in some areas would be offset by steep cuts or program eliminations in other energy areas, the House and the Senate would provide increases across the board for renewables, energy conservation, and fossil fuels R&D programs.

In renewable energy, the Senate would add to the request for every program, starting with hydrogen R&D at \$244 million, up dramatically from \$153 million in 2006 (see Table and Figure 3). Biomass R&D would climb 22 percent to \$244 million, nearly triple last year's funding, while solar energy R&D would total \$180 million, up 13 percent from 2007 and more than double the \$82 million in 2006. The Senate would turn a requested cut in wind energy R&D into a 17 percent increase to \$58 million, and would save geothermal R&D from proposed elimination with a \$25 million appropriation. The Senate would also restore funding to the now-dormant hydropower program with \$10 million. Also proposed for a big increase is nuclear energy R&D, a renewable energy technology funded in a separate account, up 26 percent to \$139 million in 2008. These programs were heavily earmarked in the recent past to 2006, and after a one-year moratorium earmarks reappear in the 2008 Senate bill, though they are now in a separate account and would not impact the above totals. Of the earmarks for renewable energy and energy conservation in the Senate bill, \$56 million would go to R&D projects (see Table).

The Senate joins the House in once again reversing proposed cuts in many energy conservation and fossil energy R&D programs, as in 2007. The Senate would allocate \$618 million for fossil energy R&D, up a dramatic 25 percent instead of a 27 percent requested cut. The Senate would boost coal R&D funding with a \$550 million appropriation, up 29 percent, including \$88 million for the FutureGen program to develop a carbon-neutral, coal-fired electricity and hydrogen production plant. Funding for the Clean Coal Power Initiative program to develop cleaner coal-based power plants would also increase from \$60 million to \$88 million. The House and the Senate would both add \$53 million to the request for carbon sequestration R&D to bring the 2008 total to \$132 million, double the funding the program had in 2006. At the same time, the House and the Senate would once again reverse the proposed eliminations of the oil R&D and gas R&D programs. The key difference between the House and the Senate is that the House would agree to DOE's request to block \$50 million in mandatory funding for an ultra-deepwater and unconventional natural gas and other petroleum research fund that was created in the Energy Policy Act of 2005 for a 2007 start. Congress declined to block 2007 funding, so DOE and the consortium selected to manage the effort recently finalized a 10-year contract for this research effort, paid for out of oil and gas royalty fees. The House would block 2008 funding in order to shift money to other programs, while so far the Senate has not touched this program, thus adding \$50 million to 2008 Fossil Energy spending.

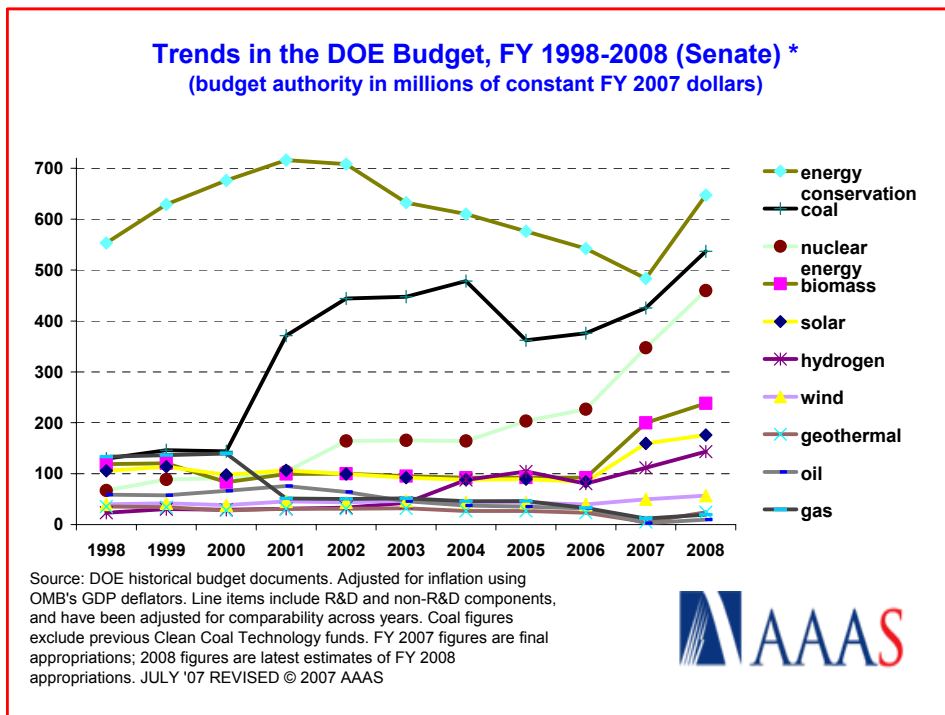


Figure 3. (click on the image for PDF)

The Energy Conservation portfolio is now part of the Energy Supply and Conservation program, and both the House and Senate would provide increases instead of proposed cuts for its component Vehicle Technologies, Building Technologies and Industrial Technologies parts. The Senate's increases would be so large that they would mostly reverse the past five years' worth of steep cuts in these programs (see Figure 3), reflecting the Senate's insistence on a balanced energy R&D portfolio.

DOE Defense R&D

DOE and its predecessors have long had responsibility for managing the nation's nuclear weapons stockpile, supplying nuclear reactors to the Navy, and dealing with the environmental consequences of nuclear weapons work. **DOE's defense R&D to address these responsibilities would gain 5.1 percent or \$190 million to \$3.9 billion in 2008 in the Senate** (see Table). The core Weapons Activities program, which funds science-based alternatives to nuclear testing in order to maintain the U.S. nuclear weapons stockpile, would receive \$2.7 billion in the Senate for R&D (up 2.9 percent) instead of a cut in the House.

The DOE proposal to initiate research on a new generation of nuclear weapons has been opposed by Congress so far, and the **House Energy-Water bill makes that opposition emphatic by zeroing out funding for the Reliable Replacement Warhead (RRW) project** to explore new warhead designs for use with existing nuclear weapons. The Senate, while it expresses reservations about the project, would keep it alive with \$66 million, \$23 million than requested but still nearly double the current funding level. DOE recently selected Lawrence Livermore to design the RRW, but the project still faces continuing skepticism in Congress over whether the U.S. needs new warheads.

Congress would provide large boosts to nonproliferation R&D and environmental cleanup R&D.

The nonproliferation and verification R&D program would receive \$322 million in the Senate (see Table), up 6.2 percent from the current year, while the House would provide even more. The environmental management R&D program to develop better cleanup technologies for nuclear waste from six decades of nuclear weapons making would receive \$55 million in the Senate, more than double the current funding level of \$21 million; the House would provide an unprecedented \$108 million.

Outlook and Next Steps

The full Senate is expected to debate and approve the Energy-Water bill sometime in July, although this could slip into September because of a crush of other Senate business. The House is expected to take up its version next week. Congress will try to send a final version of the bill to President Bush before the October 1 start of FY 2008. The President has threatened to veto any 2008 appropriations bill that exceeds his request, as the Senate version does by \$1.8 billion, so the bill may have to go through several rewrites and revotes before it can become law.

(This analysis is one of a series of AAAS R&D Funding Updates on FY 2008 congressional appropriations. The complete series of AAAS R&D Funding Updates, including continually updated analyses of R&D in FY 2008 appropriations, is available on the AAAS R&D Web Site (<http://www.aaas.org/spp/rd>) in the "FY 2008 R&D" or the "What's New" sections.)

- July 12, 2007
AAAS R&D Budget and Policy Program
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Table. DOE R&D in FY 2008 Senate Appropriations

**Table. Department of Energy
Senate Appropriations Committee Action on R&D in the FY 2008 Budget
(budget authority in millions of dollars)**

	FY 2007 Estimate	FY 2008 Request	FY 2008 House	Action by Senate				
				FY 2008 Senate	Chg. from Request Amount	Chg. from Request Percent	Chg. from FY 2007 Amount	Chg. from FY 2007 Percent
DOE Appropriations Containing R&D:								
1. Energy Supply & Conservation 1/	969	974	1,247	1,294	320	32.9%	325	33.5%
2. Science	3,511	4,052	4,102	4,141	89	2.2%	630	18.0%
3. Fossil Energy R&D	493	359	504	618	259	72.2%	125	25.4%
4. Atomic Energy Defense Activities	3,699	3,796	3,848	3,889	93	2.5%	190	5.1%
5. Radioactive Waste Management	60	53	53	53	0	0.0%	-7	-11.7%
Total DOE R&D	8,732	9,234	9,753	9,995	761	8.2%	1,263	14.5%
1. Energy Supply and Conservation 1/								
Efficiency and Renewables 1/	760	761	997	1,021	260	34.1%	261	34.3%
- Hydrogen Technology	194	213	195	228	15	7.0%	34	17.8%
- Biomass and Biorefinery Sys.	200	179	250	244	65	36.1%	44	22.2%
- Solar Energy	159	148	200	180	32	21.4%	21	12.9%
- Wind Energy	49	40	58	58	17	43.5%	8	16.6%
- Geothermal Tech.	5	0	44	25	25	--	20	400.0%
- Hydropower	0	0	22	10	10	--	10	--
- Vehicle Tech.	188	176	235	230	54	30.6%	42	22.3%
- Building Tech.	104	86	146	137	51	58.5%	33	31.3%
- Industrial Tech.	57	46	57	57	11	23.9%	0	0.8%
- Congressional projects 4/	0	0	0	56	56	--	56	--
- minus demos & other non-R&D	-196	-128	-211	-204	-76	59.1%	-8	4.1%
Electricity Delivery & Reliability	99	88	88	135	47	53.0%	36	36.0%
Nuclear Energy	110	125	162	139	14	11.1%	29	26.2%
TOTAL Energy Supply 1/	969	974	1,247	1,294	320	32.9%	325	33.5%
2. Science								
High Energy Physics	752	782	782	789	7	0.9%	37	5.0%
Nuclear Physics	423	471	471	471	0	0.0%	49	11.5%
Fusion Energy Sciences	319	428	428	428	0	0.0%	109	34.1%
Basic Energy Sciences	1,250	1,498	1,498	1,512	14	0.9%	262	21.0%
Adv. Scientific Computing Res.	283	340	340	335	-5	-1.6%	51	18.2%
Biological and Environmental Res.	483	532	582	605	73	13.8%	122	25.2%
TOTAL Science R&D	3,511	4,052	4,102	4,141	89	2.2%	630	18.0%
Science Non-R&D Items	287	346	412	356	10	2.9%	69	24.2%
Total Science Budget (incl nonR&D)	3,797	4,398	4,514	4,497	99	2.2%	699	18.4%
3. Fossil Energy R&D 2/ (does not include non-R&D components)								
Coal Research	426	427	557	550	123	28.9%	124	29.2%
- Clean Coal Power Init.	60	73	73	88	15	20.5%	28	45.6%
- FutureGen	54	108	108	88	-20	-18.5%	34	63.0%
- Carbon sequestration	100	79	132	132	53	66.9%	32	32.0%
- Other Fuels and Power Sys.	211	167	244	242	76	45.3%	31	14.5%
Oil Technology	3	0	3	10	10	--	7	270.4%
Natural Gas Technology	12	0	12	20	20	--	8	66.7%
UltraDeepwater Unconven. Gas 2/	50	0	0	50	50	--	0	0.0%
Clean Coal Tech. 3/	0	-58	-58	-58	0	0.0%	-58	--
Congressional Projects 3/	0	0	0	35	35	--	35	--
Other Programs, and adjts.	3	-10	-10	11	21	-218.7%	9	346.5%
Total Fossil Energy R&D 2/	493	359	504	618	259	72.2%	125	25.4%

(continued)

Table. DOE R&D in FY 2008 Senate Appropriations

4. Atomic Energy Defense Activities

National Nuclear Security Administration (NNSA)

Naval Reactors	750	776	776	776	0	0.0%	26	3.5%
Weapons Activities	2,655	2,730	2,476	2,733	3	0.1%	78	2.9%
<i>(Reliable Replacement Warhead)</i>	36	89	0	66	-23	-25.6%	30	84.1%
<i>(Science Campaigns)</i>	270	273	202	273	0	0.0%	3	1.0%
<i>(Adv. Simulation and Computing)</i>	612	586	536	611	25	4.3%	-1	-0.2%
<i>(Inertial Confinement Fusion)</i>	490	412	524	459	47	11.4%	-31	-6.2%
<i>(All Other Weapons Acts. R&D)</i>	1,247	1,370	1,215	1,324	-46	-3.4%	77	6.2%
Nonproliferation & Verification R&D	270	266	484	322	56	21.1%	52	19.2%
Total NNSA R&D	3,675	3,772	3,736	3,831	59	1.6%	156	4.2%
Environmental Management	21	21	108	55	34	162.4%	34	162.4%
Other AEDA R&D	3	3	3	3	0	0.0%	0	0.0%
TOTAL Atomic Defense R&D	3,699	3,796	3,848	3,889	93	2.5%	190	5.1%

DOE R&D by Budget Function:

Defense	3,699	3,796	3,848	3,889	93	2.5%	190	5.1%
General Science	3,511	4,052	4,102	4,141	89	2.2%	630	18.0%
Energy	1,522	1,386	1,803	1,965	579	41.8%	443	29.1%

AAAS estimates based on FY 2008 appropriations bills. Includes conduct of R&D and R&D facilities.

FY 2007 and FY 2008 request figures based on OMB R&D data and supplemental agency budget data.

Some data adjusted by AAAS from DOE budget documents.

FY 2007 figures include 2007 supplemental appropriations enacted in Public Law 110-28.

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

1/ Combined from the former Energy Supply and Energy Conservation accounts.

2/ There is \$50 million in mandatory funding for ultra-deepwater and unconventional natural gas R&D in FY 2007 and FY 2008, but the FY 2008 request and House appropriation defer these funds.

3/ Rescissions and deferrals of previously appropriated funds.

4/ FY 2008 Senate bill contains separate listing of earmarks.

July 12, 2007 - AAAS estimates of Senate Appropriations Committee-approved appropriations.

These figures may be amended or rejected by the full Senate.

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

	FY 2007 Estimate	FY 2008 Request	Senate		Action by Senate			
			FY 2008 House	FY 2008 Senate	Chg. from Request Amount	Chg. from Request Percent	Chg. from FY 2007 Amount	Chg. from FY 2007 Percent
Weapons Activities (NNSA)	6,276	6,511	5,879	6,489	-22	-0.3%	213	3.4%
Other NNSA Activities	2,940	2,876	2,908	3,076	200	7.0%	135	4.6%
Total NNSA	9,216	9,387	8,787	9,565	178	1.9%	349	3.8%
Defense Environmental Cleanup	5,732	5,364	5,767	5,690	326	6.1%	-41	-0.7%
Nuclear Waste and Other Defense	983	1,056	896	1,008	-49	-4.6%	25	2.5%
Total DOE defense	15,931	15,807	15,450	16,262	456	2.9%	332	2.1%
Science	3,797	4,398	4,514	4,497	99	2.2%	699	18.4%
Energy Supply and Conservation 1/	2,155	2,188	2,767	2,640	452	20.6%	485	22.5%
Fossil Energy	593	567	709	808	241	42.6%	215	36.4%
Other Energy Programs	937	1,186	1,086	1,031	-155	-13.1%	93	10.0%
Nondefense Environmental Mngmt.	350	181	286	195	15	8.0%	-154	-44.1%
Power Marketing Administrations	271	240	240	270	30	12.5%	0	-0.1%
Departmental Administration & IG	196	196	191	195	-2	-0.9%	-1	-0.6%
Total DOE Budget	24,228	24,763	25,243	25,898	1,135	4.6%	1,670	6.9%

Source: Department of Energy budget justification and FY 2008 appropriations bills.

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

FY 2007 figures include 2007 supplemental appropriations enacted in Public Law 110-28.

Includes R&D and non-R&D components. Figures are rounded to the nearest million.

1/ Combined from the former Energy Supply and Energy Conservation accounts.

July 12, 2007 - AAAS estimates of Senate Appropriations Committee-approved appropriations