

Appendix C

Data for Figures

Chapter Three

Data for Figure 3-1 .— Historical Fusion Funding, 1951-88 (millions of 1986 dollars)

Year	Operating			Capital equipment		Construction	
	Budget authority	Budget authority	Index	Budget authority	Index	Budget authority	Index
1951 -53	1.1	1.1	0.200	a		a	
1954	1.8	1.8	0.202	a		a	
1955	6.1	4.7	0.203	a		1.4	0.162
1956	7.4	6.6	0.202	a		0.8	0.167
1957	11.6	10.7	0.205	a		0.9	0.175
1958	29.2	18.4	0.212	a		10.8	0.182
1959	28.9	27.0	0.218	a		1.9	0.189
1960	33.7	31.0	0.220	2.2	0.260	0.5	0.196
1961	30.0	29.0	0.224	1.0	0.260	a	
1962	24.8	23.0	0.226	1.8	0.261	a	
1963	25.5	24.2	0.228	1.3	0.262	a	
1964	22.6	21.0	0.231	1.6	0.263	a	
1965	23.1	21.3	0.234	1.8	0.266	a	
1966	23.1	21.8	0.238	1.3	0.269	a	
1967	23.9	22.4	0.243	1.5	0.276	a	
1968	26.6	24.7	0.252	1.8	0.285	0.1	0.247
1969	29.7	26.5	0.263	1.6	0.295	1.6	0.264
1970	34.3	27.7	0.277	2.0	0.305	4.6	0.284
1971	32.2	28.3	0.291	2.1	0.319	1.8	0.310
1972	33.3	31.0	0.310	2.1	0.327	0.2	0.344
1973	39.7	37.0	0.320	2.5	0.334	0.2	0.368
1974	57.4	52.9	0.353	4.3	0.351	0.2	0.393
1975	118.2	97.9	0.382	19.8	0.376	0.5	0.444
1976	166.3	131.1	0.429	17.0	0.489	18.2	0.484
TQ ^b	52.9	42.6	0.429	4.5	0.489	5.8	0.484
1977	316.3	195.0	0.459	23.0	0.518	98.3	0.516
1978	332.4	206.7	0.493	29.6	0.568	96.1	0.564
1979	355.1	211.3	0.529	27.2	0.619	116.6	0.613
1980	350.3	235.1	0.588	29.8	0.684	85.4	0.675
1981	393.6	258.3	0.674	36.9	0.777	98.5	0.746
1982	451.2	295.1	0.766	42.0	0.847	114.1	0.814
1983	461.3	373.8	0.829	39.5	0.893	48.0	0.865
1984	468.4	391.1	0.892	37.8	0.947	39.5	0.882
1985	429.6	369.6	0.938	27.5	0.954	32.5	0.934
1986	361.5	320.5	1.000	28.3	1.000	12.7	1.000
1987 (estimate) . .	327.3	302.2	1.043	17.1	1.051	8.0	1.025
1988 (request) . .	320.1	286.1	1.080	18.1	1.088	15.9	1.060

aNo expenditures occurred in this category during the war

bThe start of the fiscal year was changed in 1976 from July 1 to October 1. TQ represents the budget for the transition quarter from July 1, 1976 to September 30, 1976

SOURCE U.S Department of Energy, Office of Energy Research, letter to OTA project staff, Aug 15, 1986, updated by personal communication to OTA staff Sept 2, 1987

Data for Figure 3-2.— Historical Fusion Funding, 1951-88 (millions of current dollars)

Year	Presidential budget request budget authority	Total budget authority (in millions)	Year	Presidential budget request budget authority	Total budget authority (in millions)
1951-53	a	1.1	1972	a	33.3
1954	a	1.8	1973	a	39.7
1955	a	6.1	1974	a	57.4
1956	a	7.4	1975	102.3	118.2
1957	a	11.6	1976	144.2	166.3
1958	a	29.2	TQ ^b	44.4	52.9
1959	a	28.9	1977	291.1	316.3
1960	a	33.7	1978	370.9	332.4
1961	a	30.0	1979	334.0	355.1
1962	a	24.8	1980	364.1	350.3
1963	a	25.5	1981	403.6	393.6
1964	a	22.6	1982	460.0	451.2
1965	a	23.1	1983	444.1	461.3
1966	a	23.1	1984	467.0	468.4
1967	a	23.9	1985	482.7	429.6
1968	a	26.6	1986	390.0	361.5
1969	a	29.7	1987 (estimate)	333.0	341.4
1970	a	34.3	1988 (request)	345.6	
1971	a	32.2			

aPresidential budget requests before 1975 were not available from DOE.

bThe start of the fiscal year was changed in 1976 from July 1 to October 1. TQ represents the budget for the transition quarter from July 1, 1976 to September 30, 1976.

SOURCE: US. Department of Energy, Office of Energy Research, letter to OTA project staff, Aug. 15, 1986.

Chapter Six

Data for Figure 6-1.— Federal Funding of Plasma Physics in 1984 (millions of 1984 dollars)

Plasma Physics Area	DOE	NSF	DoD	NASA	NOAA	Total
General Plasma Physics	3	3	68	0	0	74
Magnetic Conf. Fusion	471	0	0	0	0	471
Inertial Conf. Fusion	170	0	0	0	0	170
Space/Astrophysical Plasma	2	30	5	100	2	139
Total	646	33	73	100	2	854

DOE = Department of Energy

NSF = National Science Foundation

DoD = Department of Defense

NASA = National Aeronautics and Space Administration

NOAA = National Oceanic and Atmospheric Administration

SOURCE: National Research Council, *Physics Through the 1990s: Plasmas and Fluids* (Washington, DC: National Academy Press, 1986), p. 33

Data for Figure 6-2.— Defense and Civilian Federal Research and Development Expenditures (billions of current dollars)

Year	Defense	Civilian	Total
1982	22.9	15.8	38.7
1983	25.6	14.4	40.0
1984	30.5	15.5	46.0
1985	34.7	17.0	51.7
1986	37.6	17.0	54.6
1987 (estimate)	41.2	18.6	59.8
1988 (request)	48.1	21.3	69.4

NOTE: Defense: includes Department of Defense along with Department of Energy atomic energy defense activities. civilian: Includes all Federal research and development not included in defense.

SOURCE: American Association for the Advancement of Science, *AAAS Report XII Research and development FY 1988* (Washington, DC: American Association for the Advancement of Science, 1987)

**Data for
Figure 6-3.— Major Components in Federally Funded Research and Development (in 1987 dollars)
and**

Figure 6-4.— Historical Component Funding Levels for Federal Research and Development (billions of current dollars)

Year	Defense	Energy	Space	Health	Science	Other
1982	22.9	3.5	3.6	4.1	1.5	3.1
1983	25.6	2.9	1.7	4.5	1.6	3.7
1984	30.5	2.6	2.0	5.1	1.9	3.9
1985	34.7	2.5	2.4	5.8	2.1	4.2
1986	37.6	2.4	1.9	5.9	2.1	4.7
1987 (estimate)	41.2	2.2	2.4	7.0	2.2	4.8
1988 (request)	48.1	2.0	3.1	9.0	2.6	4.7

NOTE Defense Includes Department of Defense along with Department of Energy atomic energy defense activities Energy Includes Department of Energy activities, less general science and defense, Nuclear Regulatory Commission, and Environmental Protection Agency Space includes National Aeronautics and Space Administration less space applications and aeronautical research Health includes Department of Health and Human Services, Veterans Administration, Department of Education, and Environmental Protection Agency Science includes National Science Foundation and Department of Energy high energy physics and nuclear physics

SOURCE American Association for the Advancement of Science, *AAAS Report X// Research and Development FY 1988* (Washington, DC American Association for the Advancement of Science, 1987)

**Data for Figure 6-5.— Annual Appropriations of DOE Civilian Research and Development Programs
(millions of current dollars)**

Year	Solar/renewables *	Fusion	Fission	Fossil	Conservation
1980	731.4	350.3	847.8	847.8	296.1
1981	711.2	393.6	817.0	821.3	292.5
1982	341.1	451.2	819.4	566.8	151.9
1983	261.2	461.3	701.7	310.9	133.5
1984	211.9	468.4	622.9	331.5	150.1
1985	201.7	429.6	412.6	349.4	175.5
1986 (estimate)	173.6	361.5	358.1	343.0	170.9
1987 (estimate)	146.3	341.4	329.3	451.0	160.7
1988 (request)	93.5	345.6	336.4	368.5	80.1

*Solar/Renewables Includes Solar, Geothermal, and Hydroelectric programs.

SOURCE: Fusion—U S Department of Energy, Office of Energy Research, letter to OTA project staff, Aug 15, 1986 Others —"Analysis of Trends in Civilian R&D Appropriations for the U.S. Department of Energy," prepared by Argonne National Laboratory, August 1986, table B 3, p 49

**Data for Figure 6-6.— Major DOE Civilian Research and
Development Funding at National Laboratories in
Fiscal Year 1987 (millions of 1987 dollars)**

Solar and Other Renewable	\$114.5
Electric Systems	19.6
Environment	133.3
Conservation	49.5
Fossil Energy	116.6
Supporting Research	360.0
Nuclear Energy	254.3
Magnetic Fusion	245.6

SOURCE U S Department of Energy, *FY 1988 Congressional Budget Estimates for Laboratories/Programs*, January 1987

Chapter Seven

Data for
Figure 7-1.—Comparison of International Fusion Budgets (current dollars)
and
Figure 7.2.—Comparison of International Equivalent Person-Years

United States:

Year	Fusion budget (in millions \$)	Average industrial hourly wage (\$)	Person-years
1980	350.3	7.27	23,165
1981	393.6	7.99	23,683
1982	451.2	8.50	25,520
1983	461.3	8.84	25,088
1984	468.4	9.16	24,584
1985	429.6	9.57	21,582
1986	361.5	10.04	17,310

Japan:

Year	Fusion budget (yen)	Fusion budget (in millions \$)	Average industrial hourly wage (yen)	Average industrial hourly wage(\$)	Person-years
1980	52,256	230	1,293	5.70	19,430
1981	61,115	277	1,373	6.22	21,400
1982	72,025	289	1,225	5.72	24,300
1983	69,112	291	1,490	6.28	22,300
1984	60,392	251	1,561	6.50	18,600
1985	65,154	271	1,640	6.83	19,100
1986	64,861	381	1,704	10.02	18,300

European Community:

Year	Fusion budget (MECU)	Fusion budget (in millions \$)	Average industrial hourly wage(\$)	Person-Years
1980	190	264	5.93	21,404
1981	225	254	5.35	22,815
1982	300	297	5.20	27,457
1983	300	300	5.06	28,532
1984	350	298	4.60	31,086
1985	350	245	4.06	28,977
1986	375	338	5.60	28,990

SOURCE: U.S. Department of Energy, Office of Energy Research, staff memorandum to file. Oct.9, 1986

Data for Figure 7-3.— Comparison of international Fusion Budgets by Percentage Gross National Product^a

Year	United States		European Community		Japan	
	GNP	Fusion/GNP	GNP ^b	Fusion/GNP	GNP	Fusion/GNP
1980	2,632	0.0133	1,962	0.0135	899	0.0271
1981	2,958	0.0133	2,131	0.0119	964	0.0287
1982	3,069	0.0147	2,277	0.0130	1,060	0.0273
1983	3,305	0.0139	2,394	0.0125	1,138	0.0256
1984	3,363	0.0128	data	unavailable	data	unavailable

^aAll Gross National Products are shown in billions of current dollars^bThe GNP for the European Community is computed by adding the GNP's of the major EC countries (Belgium, France, Federal Republic of Germany, Greece, Italy, Netherlands, and the United Kingdom)

SOURCE: Gross National Products found in Statistical Abstract, No 1742