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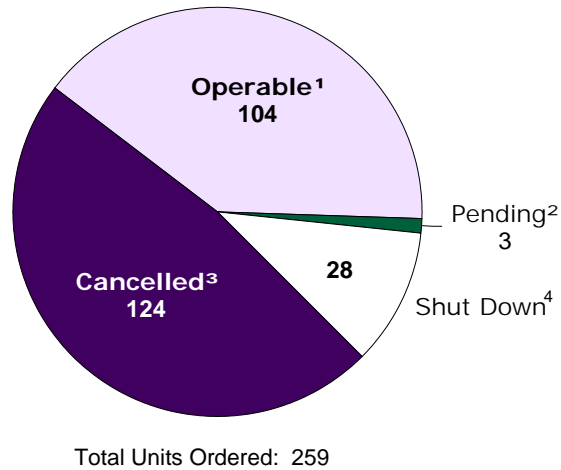
Nuclear Energy



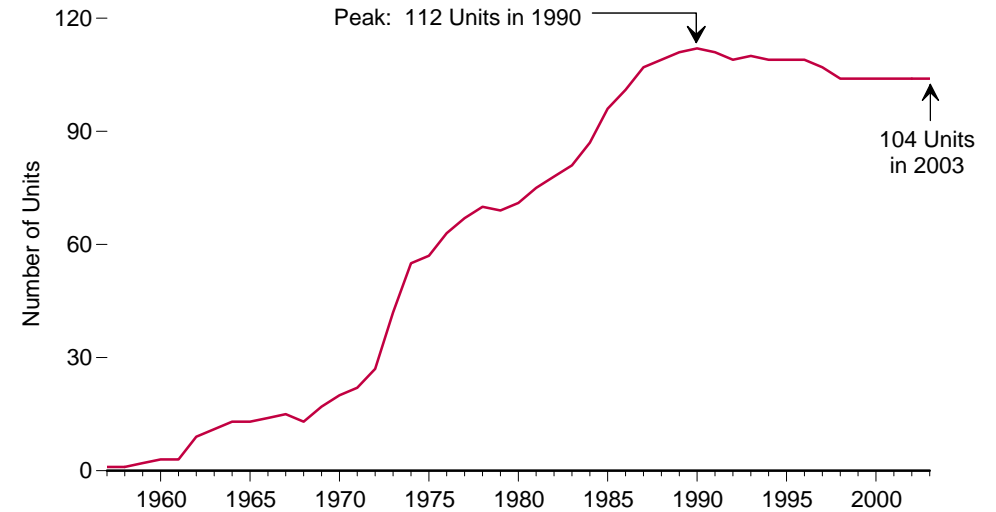
Site of Shippingport atomic power station, the first commercial nuclear power plant in the United States (rectangular reactor building and foreground); background, Beaver Valley 1 and 2 nuclear power plants and Bruce Mansfield coal-fired power plant (southwestern Pennsylvania). Source: U.S. Department of Energy.

Figure 9.1 Nuclear Generating Units

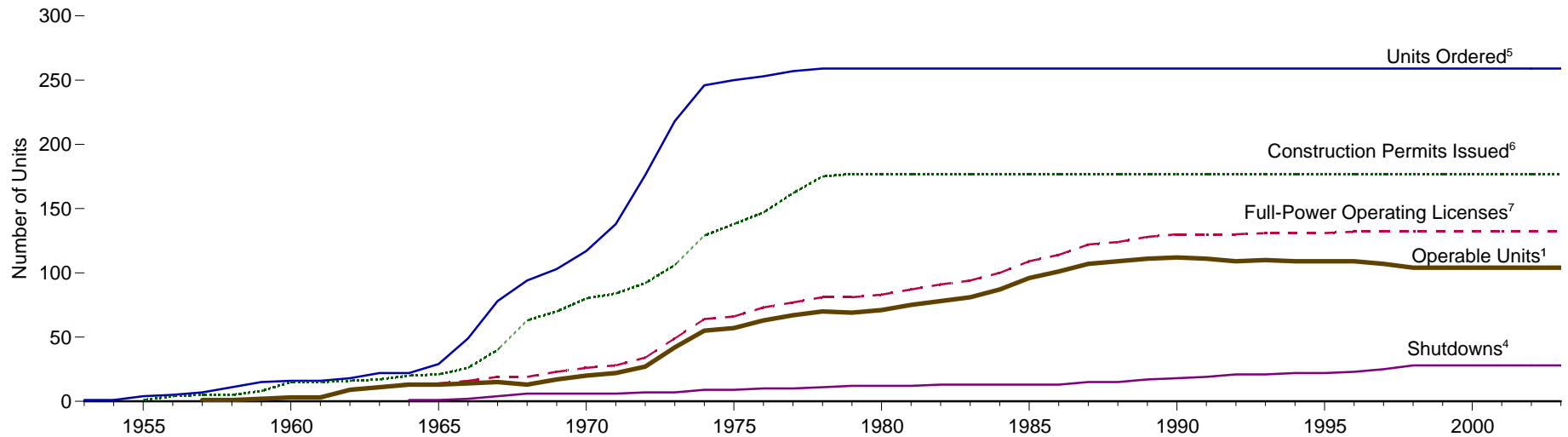
Status of All Ordered Units, 1953-2003



Operable Units,¹ 1957-2003



Operable Units and Cumulative Orders, Permits, Licenses, and Shutdowns, 1953-2003



¹ Units holding full-power operating license, or equivalent permission to operate.

² Bellefonte 1 and 2 and Watts Bar 2, where construction has been stopped indefinitely.

³ Includes WNP 1; the licensee intends to request that the construction permit be cancelled.

⁴ Ceased operation permanently.

⁵ Placement of an order by a utility or government agency for a nuclear steam supply system.

⁶ Issuance by a regulatory authority of a permit, or equivalent permission, to begin construction.

⁷ Issuance by regulatory authority of full-power operating license, or equivalent permission.

Note: Data are at end of year.

Source: Table 9.1.

Table 9.1 Nuclear Generating Units, 1953-2003

Year	Orders ¹	Cancelled Orders ²	Construction Permits ³	Low-Power Operating Licenses ⁴	Full-Power Operating Licenses ⁵	Shutdowns ⁶	Operable Units ⁷
1953	1	0	0	0	0	0	0
1954	0	0	0	0	0	0	0
1955	3	0	1	0	0	0	0
1956	1	0	3	0	0	0	0
1957	2	0	1	1	1	0	1
1958	4	0	0	0	0	0	1
1959	4	0	3	1	1	0	2
1960	1	0	7	1	1	0	3
1961	0	0	0	0	0	0	3
1962	2	0	1	7	6	0	9
1963	4	0	1	3	2	0	11
1964	0	0	3	2	3	1	13
1965	7	0	1	0	0	0	13
1966	20	0	5	1	2	1	14
1967	29	0	14	3	3	2	15
1968	16	0	23	0	0	2	13
1969	9	0	7	4	4	0	17
1970	14	0	10	4	3	0	20
1971	21	0	4	5	2	0	22
1972	38	7	8	6	6	1	27
1973	42	0	14	12	15	0	42
1974	28	9	23	14	15	2	55
1975	4	13	9	3	2	0	57
1976	3	1	9	7	7	1	63
1977	4	10	15	4	4	0	67
1978	2	13	13	3	4	1	70
1979	0	6	2	0	0	1	69
1980	0	15	0	5	2	0	71
1981	0	9	0	3	4	0	75
1982	0	18	0	6	4	1	78
1983	0	6	0	3	3	0	81
1984	0	6	0	7	6	0	87
1985	0	2	0	7	9	0	96
1986	0	2	0	7	5	0	101
1987	0	0	0	6	8	2	107
1988	0	3	0	1	2	0	109
1989	0	0	0	3	4	2	111
1990	0	1	0	1	2	1	112
1991	0	0	0	0	0	1	111
1992	0	0	0	0	0	2	109
1993	0	0	0	1	1	0	110
1994	0	1	0	0	0	1	109
1995	0	2	0	1	0	0	109
1996	0	0	0	0	1	1	109
1997	0	0	0	80	80	2	107
1998	0	0	0	0	0	3	104
1999	0	0	0	0	0	0	104
2000	0	0	0	0	0	0	104
2001	0	0	0	0	0	0	104
2002	0	0	0	0	0	0	104
2003	0	0	0	0	0	0	104
Total	259	124	177	132	132	28	—

¹ Placement of an order by a utility or government agency for a nuclear steam supply system.

² Cancellation by utilities of ordered units. Includes WNP 1; the licensee intends to request that the construction permit be cancelled. Does not include three units (Bellefonte 1 and 2 and Watts Bar 2) where construction has been stopped indefinitely.

³ Issuance by regulatory authority of a permit, or equivalent permission, to begin construction. Numbers reflect permits issued in a given year, not extant permits.

⁴ Issuance by regulatory authority of license, or equivalent permission, to conduct testing but not to operate at full power.

⁵ Issuance by regulatory authority of full-power operating license, or equivalent permission. Units generally did not begin immediate operation.

⁶ Ceased operation permanently.

⁷ Total of nuclear generating units holding full-power licenses, or equivalent permission to operate, at the end of the year. Although Browns Ferry 1 was shut down in 1985, the unit has remained fully licensed and thus has continued to be counted as operable during the shutdown; in May 2002, the Tennessee Valley Authority announced its intention to have the unit resume operation in 2007.

⁸ Under new regulations beginning in 1997, the terms "Low-Power Operating Licenses" and "Full-Power Operating Licenses" are no longer applicable; while no new licenses have been granted under the new regulations, applications were made in 2003 for three "Early Site Permits."

— = Not applicable.

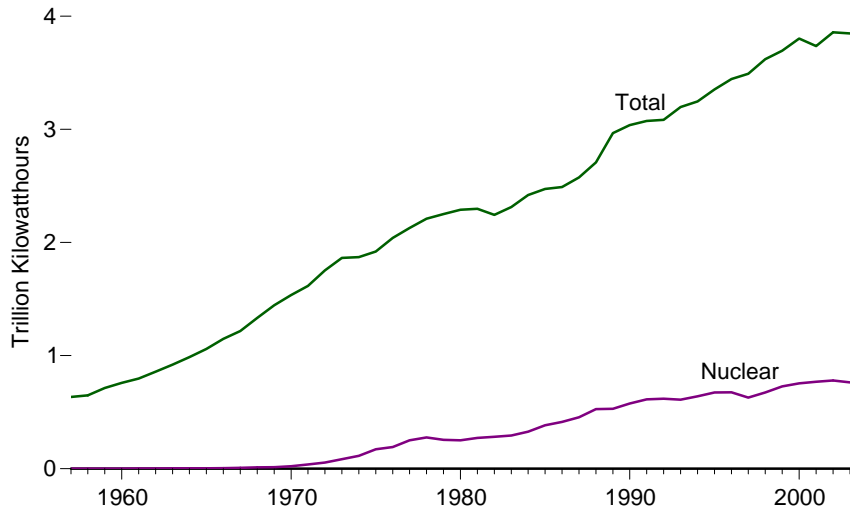
Note: See Note, "Coverage of Nuclear Energy Statistics," at end of section.

Web Page: For related information, see <http://www.eia.doe.gov/fuelnuclear.html>.

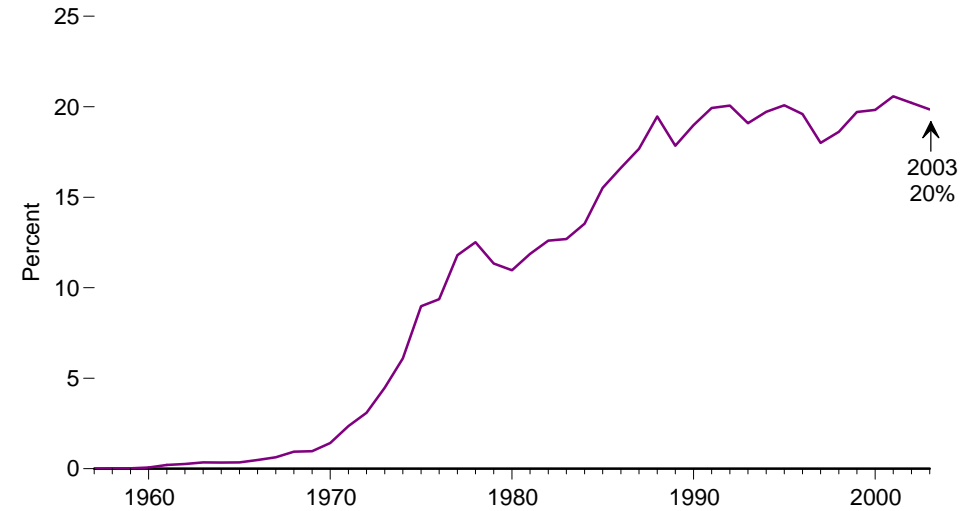
Sources: **Operable Units:** • 1953-1982—Compiled from various sources, primarily U.S. Department of Energy (DOE), Office of Nuclear Reactor Programs, "U.S. Central Station Nuclear Electric Generating Units: Significant Milestones." • 1983 forward—Energy Information Administration (EIA), Form EIA-860, "Annual Electric Generator Report," and predecessor forms. **All Other Data:** • 1953-1997—U.S. Atomic Energy Commission, *1973 Annual Report to Congress, Volume 2, Regulatory Activities*; Nuclear Energy Institute, *Historical Profile of U.S. Nuclear Power Development* (1988); EIA, *Commercial Nuclear Power 1991* (September 1991); DOE, *Nuclear Reactors Built, Being Built, and Planned: 1995*; U.S. Nuclear Regulatory Commission (NRC), *Information Digest* (1997 and 1998) and "Plant Status Report"; and various utility, Federal, and contractor officials. • 1998 forward—NRC, *Information Digest*, annual reports.

Figure 9.2 Nuclear Power Plant Operations

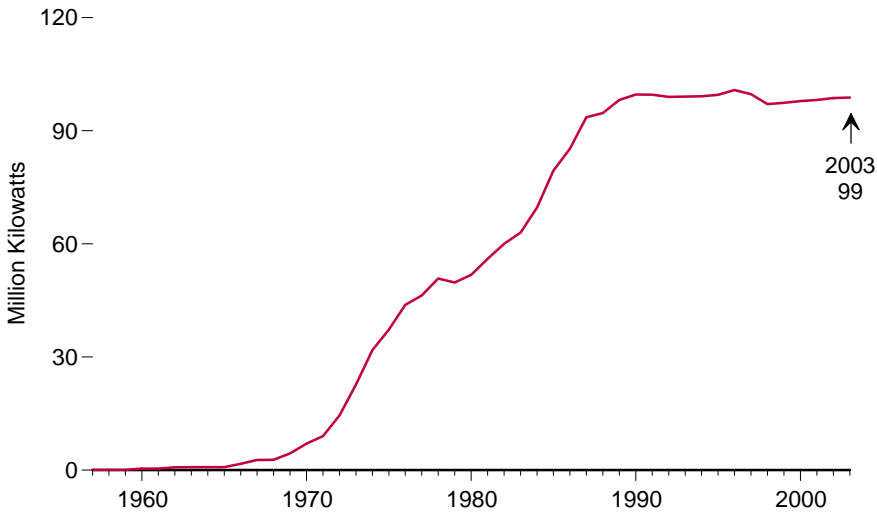
Total Electricity and Nuclear Electricity Net Generation, 1957-2003



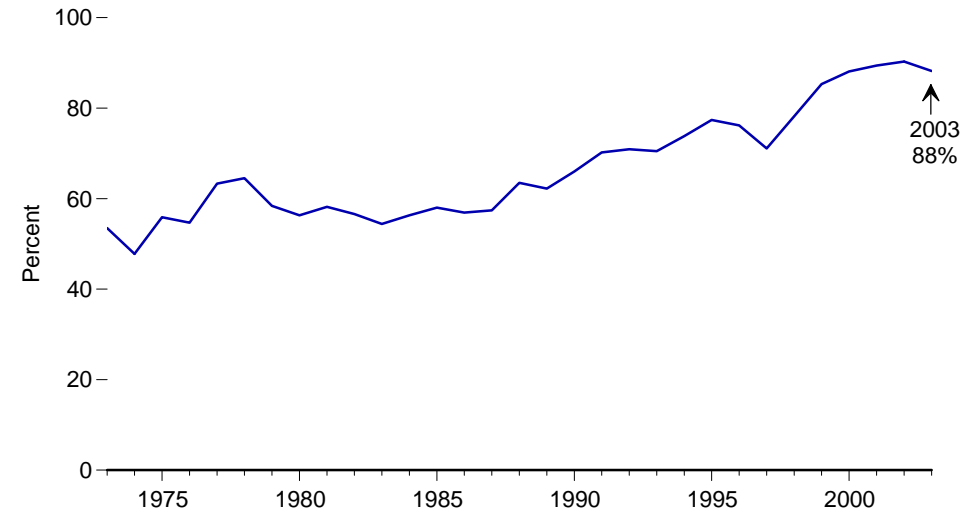
Nuclear Share of Electricity Net Generation, 1957-2003



Net Summer Capacity of Operable Units, 1957-2003



Capacity Factor, 1973-2003



Note: Because vertical scales differ, graphs should not be compared.

Sources: Tables 8.1 and 9.2.

Table 9.2 Nuclear Power Plant Operations, 1957-2003

Year	Nuclear Electricity Net Generation	Nuclear Share of Electricity Net Generation	Net Summer Capacity of Operable Units ¹	Capacity Factor ²
	Billion Kilowatthours	Percent	Million Kilowatts	Percent
1957	(s)	(s)	0.1	NA
1958	0.2	(s)	0.1	NA
1959	0.2	(s)	0.1	NA
1960	0.5	0.1	0.4	NA
1961	1.7	0.2	0.4	NA
1962	2.3	0.3	0.7	NA
1963	3.2	0.3	0.8	NA
1964	3.3	0.3	0.8	NA
1965	3.7	0.3	0.8	NA
1966	5.5	0.5	1.7	NA
1967	7.7	0.6	2.7	NA
1968	12.5	0.9	2.7	NA
1969	13.9	1.0	4.4	NA
1970	21.8	1.4	7.0	NA
1971	38.1	2.4	9.0	NA
1972	54.1	3.1	14.5	NA
1973	83.5	4.5	22.7	53.5
1974	114.0	6.1	31.9	47.8
1975	172.5	9.0	37.3	55.9
1976	191.1	9.4	43.8	54.7
1977	250.9	11.8	46.3	63.3
1978	276.4	12.5	50.8	64.5
1979	255.2	11.3	49.7	58.4
1980	251.1	11.0	51.8	56.3
1981	272.7	11.9	56.0	58.2
1982	282.8	12.6	60.0	56.6
1983	293.7	12.7	63.0	54.4
1984	327.6	13.5	69.7	56.3
1985	383.7	15.5	79.4	58.0
1986	414.0	16.6	85.2	56.9
1987	455.3	17.7	93.6	57.4
1988	527.0	19.5	94.7	63.5
1989	529.4	17.8	98.2	62.2
1990	576.9	19.0	99.6	66.0
1991	612.6	19.9	99.6	70.2
1992	618.8	20.1	99.0	70.9
1993	610.3	19.1	99.0	70.5
1994	640.4	19.7	99.1	73.8
1995	673.4	20.1	99.5	77.4
1996	674.7	19.6	100.8	76.2
1997	628.6	18.0	99.7	71.1
1998	673.7	18.6	97.1	78.2
1999	728.3	19.7	97.4	85.3
2000	753.9	19.8	97.9	88.1
2001	768.8	20.6	98.2	89.4
2002	780.1	^R 20.2	^R 98.7	^R 90.3
2003 ^P	763.7	19.8	98.8	88.2

¹ At end of year. See "Generator Net Summer Capacity" in Glossary.

² See "Generator Capacity Factor" in Glossary.

R=Revised. P=Preliminary. NA=Not available. (s)=Less than 0.05.

Note: See Note, "Coverage of Nuclear Energy Statistics," at end of section.

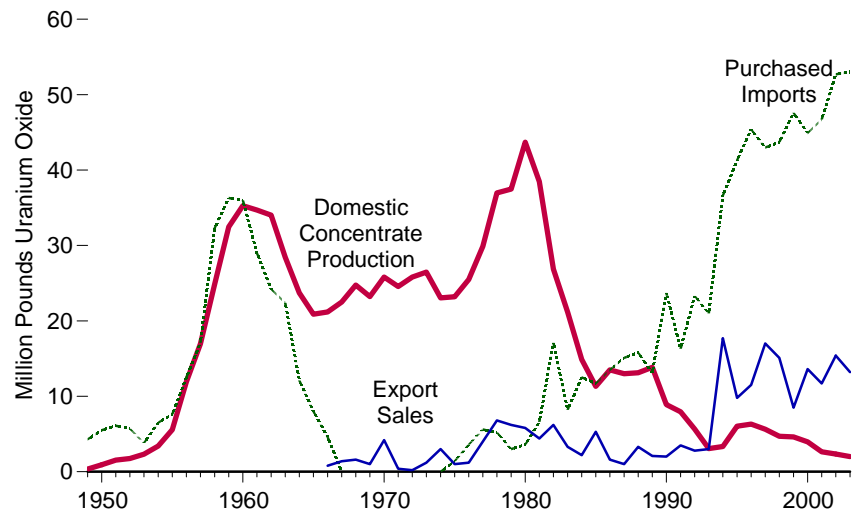
Web Page: For related information, see <http://www.eia.doe.gov/fuelnuclear.html>.

Sources: **Nuclear Electricity Net Generation** and **Nuclear Share of Electricity Net Generation**:

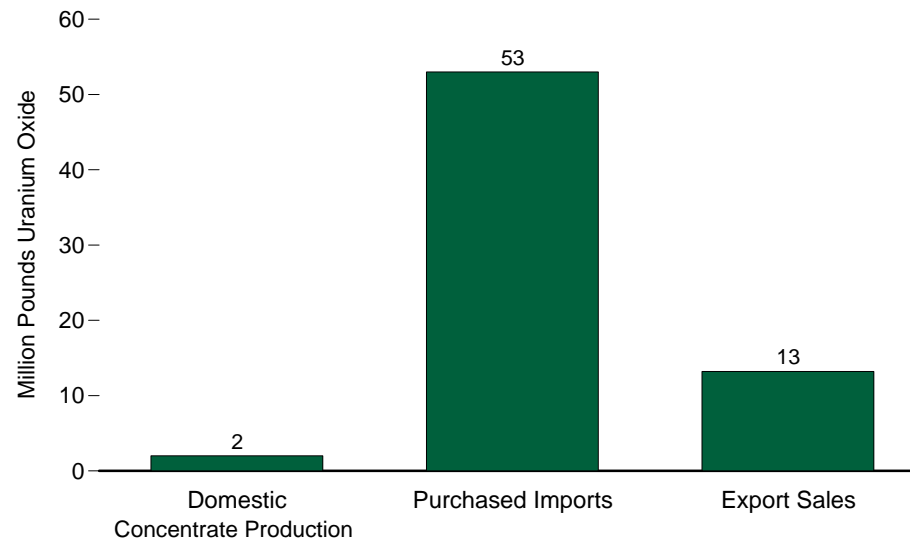
Table 8.2a. **Net Summer Capacity of Operable Units:** Table 8.11a. **Capacity Factor:** Computed as a weighted average of monthly values for the year. Monthly factors are computed as the actual monthly generation divided by the maximum possible generation for that month. The maximum possible generation is the number of hours in the month multiplied by the net summer capacity at the end of the month. That fraction is then multiplied by 100 to obtain a percentage.

Figure 9.3 Uranium Overview

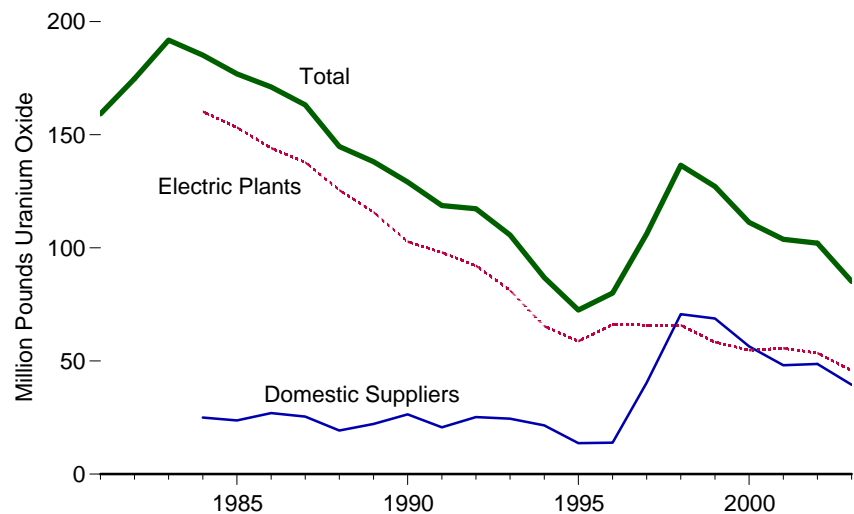
Production and Trade, 1949-2003



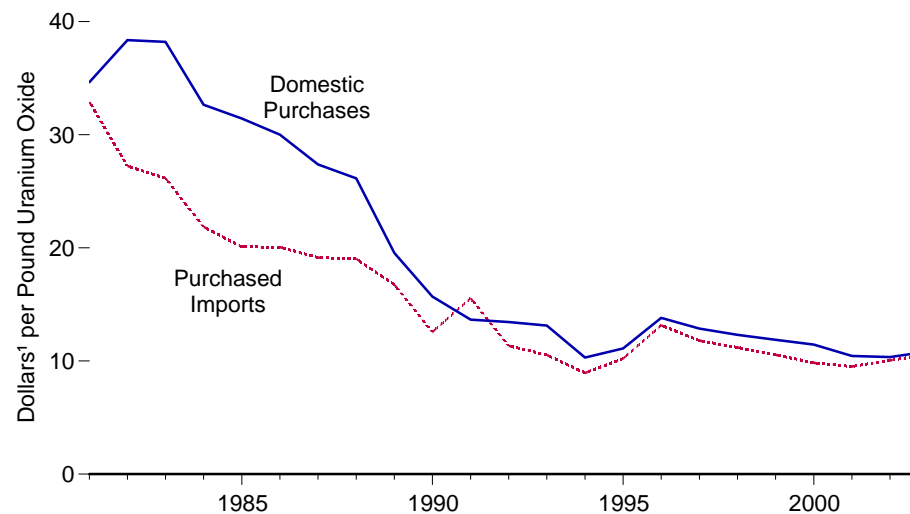
Production and Trade, 2003



Inventories, End of Year 1981-2003



Average Prices, 1981-2003



¹ Nominal dollars.

Note: Because vertical scales differ, graphs should not be compared.

Source: Table 9.3.

Table 9.3 Uranium Overview, Selected Years, 1949-2003

Year	Domestic Concentrate Production ¹	Purchased Imports ²	Export Sales ²	Electric Plant Purchases From Domestic Suppliers	Loaded Into U.S. Nuclear Reactors ³	Inventories			Average Price	
						Domestic Suppliers	Electric Plants	Total	Purchased Imports	Domestic Purchases
Million Pounds U ₃ O ₈									U.S. Dollars ⁴ per Pound U ₃ O ₈	
1949	0.36	4.3	0.0	NA	NA	NA	NA	NA	NA	NA
1950	0.92	5.5	0.0	NA	NA	NA	NA	NA	NA	NA
1955	5.56	7.6	0.0	NA	NA	NA	NA	NA	NA	NA
1960	35.28	36.0	0.0	NA	NA	NA	NA	NA	NA	NA
1965	20.88	8.0	0.0	NA	NA	NA	NA	NA	NA	NA
1970	25.81	0.0	4.2	NA	NA	NA	NA	NA	—	NA
1971	24.55	0.0	0.4	NA	NA	NA	NA	NA	—	NA
1972	25.80	0.0	0.2	NA	NA	NA	NA	NA	—	NA
1973	26.47	0.0	1.2	NA	NA	NA	NA	NA	—	NA
1974	23.06	0.0	3.0	NA	NA	NA	NA	NA	—	NA
1975	23.20	1.4	1.0	NA	NA	NA	NA	NA	NA	NA
1976	25.49	3.6	1.2	NA	NA	NA	NA	NA	NA	NA
1977	29.88	5.6	4.0	NA	NA	NA	NA	NA	NA	NA
1978	36.97	5.2	6.8	NA	NA	NA	NA	NA	NA	NA
1979	37.47	3.0	6.2	NA	NA	NA	NA	NA	NA	NA
1980	43.70	3.6	5.8	NA	NA	NA	NA	NA	NA	NA
1981	38.47	6.6	4.4	32.6	NA	NA	NA	159.2	32.90	34.65
1982	26.87	17.1	6.2	27.1	NA	NA	NA	174.8	27.23	38.37
1983	21.16	8.2	3.3	24.2	NA	NA	NA	191.8	26.16	38.21
1984	14.88	12.5	2.2	22.5	NA	25.0	160.2	185.2	21.86	32.65
1985	11.31	11.7	5.3	21.7	NA	23.7	153.2	176.9	20.08	31.43
1986	13.51	13.5	1.6	18.9	NA	27.0	144.1	171.1	20.07	30.01
1987	12.99	15.1	1.0	20.8	NA	25.4	137.8	163.2	19.14	27.37
1988	13.13	15.8	3.3	17.6	NA	19.3	125.5	144.8	19.03	26.15
1989	13.84	13.1	2.1	18.4	NA	22.2	115.8	138.1	16.75	19.56
1990	8.89	23.7	2.0	20.5	NA	26.4	102.7	129.1	12.55	15.70
1991	7.95	16.3	3.5	26.8	34.6	20.7	98.0	118.7	15.55	13.66
1992	5.65	23.3	2.8	23.4	43.0	25.2	92.1	117.3	11.34	13.45
1993	3.06	21.0	3.0	15.5	45.1	24.5	81.2	105.7	10.53	13.14
1994	3.35	36.6	17.7	22.7	40.4	21.5	65.4	86.9	8.95	10.30
1995	6.04	41.3	9.8	22.3	51.1	13.7	58.7	72.5	10.20	11.11
1996	6.32	45.4	11.5	23.7	46.2	13.9	66.1	80.0	13.15	13.81
1997	5.64	43.0	17.0	19.4	48.2	40.4	65.9	106.2	11.81	12.87
1998	4.71	43.7	15.1	21.6	38.2	70.7	65.8	136.5	11.19	12.31
1999	4.61	47.6	8.5	21.4	58.8	68.8	58.3	127.1	10.55	11.88
2000	3.96	44.9	13.6	24.3	51.5	56.5	54.8	111.3	9.84	11.45
2001	2.64	46.7	11.7	27.5	52.7	48.1	55.6	103.8	9.51	10.45
2002	E2.34	52.7	15.4	22.7	R 57.2	R 48.7	R 53.5	R 102.1	10.05	10.35
2003	E2.00	53.0	13.2	21.7	P 62.3	P 39.5	P 45.7	P 85.2	10.59	10.84

¹ See "Uranium Concentrate" in Glossary.

² Import quantities through 1970 are reported for fiscal years. Prior to 1968, the Atomic Energy Commission was the sole purchaser of all imported U₃O₈. Trade data prior to 1982 were for transactions conducted by uranium suppliers only. For 1982 forward, transactions by uranium buyers (consumers) have been included. Buyer imports and exports prior to 1982 are believed to be small.

³ Does not include any fuel rods removed from reactors and later reloaded.

⁴ Nominal dollars.

R=Revised. P=Preliminary. E=Estimate. NA=Not available. — = Not applicable.

Note: U₃O₈ is uranium oxide. See "Uranium Oxide" in Glossary.

Web Pages: • For data not shown for 1951-1969, see <http://www.eia.doe.gov/emeu/aer/nuclear.html>.
• For related information, see <http://www.eia.doe.gov/fuelnuclear.html>.

Sources: • 1949-1966—U.S. Department of Energy, Grand Junction Office, *Statistical Data of the Uranium Industry*, Report No. GJO-100, annual reports. • 1967-2002—Energy Information Administration, *Uranium Industry Annual*, annual reports. • 2003—EIA, "Domestic Uranium Production Report" (May 2004), and "Uranium Marketing Annual Report" (May 2004), Tables 5, 18, 19, 21, and 22.

Nuclear Energy

Note. Coverage of Nuclear Energy Statistics. In 1997, the Energy Information Administration undertook a major revision of Table 9.1 to more fully describe the history of the U.S. commercial nuclear power industry. The time frame was extended back to the birth of the industry in 1953, and the data categories were revised for greater relevance to current industry conditions and trends. To acquire the data for the revised categories it was necessary to develop a reactor unit database employing different sources than those used previously for Table 9.1 and still used for Table 9.2.

The data in Table 9.1 apply to commercial nuclear power units, which means that the units contributed power to the commercial electricity grid. A total of 259 units ever ordered was identified. Although most orders were placed by electric utilities, several units are or were ordered, owned, and operated wholly or in part by the Federal Government, including BONUS (Boiling Nuclear Superheater Power Station), Elk River, Experimental Breeder Reactor 2, Hallam, Hanford N, Piqua, and Shippingport.

A reactor is generally defined as operable in Table 9.1 while it possessed a full-power license from the Nuclear Regulatory Commission or its predecessor the Atomic Energy Commission, or equivalent permission to operate, at the end of the year. The definition is liberal in that it does not exclude units retaining full-power licenses during long, non-routine shutdowns. For example:

- In 1985 the five then-active Tennessee Valley Authority units (Browns Ferry 1, 2, and 3 and Sequoyah 1 and 2) were shut down under a regulatory forced outage. Browns Ferry 1 remains shut down and has been defueled, while the other units were idle for several years, restarting in 1991, 1995, 1988, and 1988, respectively. All five units are counted as operable during the shutdowns. Brown's Ferry 1 is the only one of the five TVA plants that has not returned to service. Because it is still fully licensed to operate, it continues to meet the definition of operable.
- Shippingport was shut down from 1974 through 1976 for conversion to a light-water breeder reactor, but is counted as operable until its retirement in 1982.
- Calvert Cliffs 2 was shut down in 1989 and 1990 for replacement of pressurizer heater sleeves but is counted as operable during those years.

Exceptions to the rule are Shoreham and Three Mile Island 2. Shoreham was granted a full-power license in April 1989, but was shut down two months later and never restarted. In 1991, the license was changed to Possession Only. Although not operable at the end of the year, Shoreham is treated as operable during 1989 and shut down in 1990, because counting it as operable and shut down in the same year would introduce a statistical discrepancy in the tallies. A major accident closed Three Mile Island 2 in 1979, and although the unit retained its full-power license for several years, it is considered permanently shut down since that year.