Section 6. Electricity

Electricity consumed by the end-use sectors

The U.S. Energy Information Administration (EIA) develops annual state-level electricity prices for the residential, commercial, industrial, and transportation sectors. The electricity prices in the State Energy Data System (SEDS) are average prices of electricity sold to ultimate customers in dollars per million British Thermal Unit (Btu). EIA calculates these prices as retail electric revenue divided by the corresponding electricity sales to all customers in each end-use sector. The revenue is the operating revenue and includes all charges and taxes collected.

EIA's electricity consumption data are electricity sales by the electric power sector to ultimate customers in the end use sectors. For the expenditures calculation, SEDS adjusts state-level electricity consumption in the industrial sector to remove estimated refinery use. (See the discussion in Section 7, "Consumption adjustments for calculating expenditures," at http://www.eia.gov/state/seds/seds-technical-notes-complete.php.)

Physical unit prices: 2003 forward

EIA calculates annual state-level physical unit prices for electricity, in dollars per kilowatthour, for the residential, commercial, industrial, and transportation sectors. These prices are the average revenue per kilowatthour of sales by all electric power retailers to a state. In 2003, for Missouri and Tennessee, there are transportation electricity consumption values in SEDS based on U.S. Department of Transportation data, but no comparable transportation sales and revenue in the *Electric Sales and Revenue*. SEDS estimates the prices for each of these states the annual growth rate of the commercial sector price applied to the previous year's transportation sector price.

Physical unit prices: 1990 through 2002

For 1990 through 2002, physical unit prices for states are calculated for all four sectors as the average revenue per kilowatthour of sales by all electric power retailers reporting sales to a state. Revenue and sales data from the Form EIA-861 "Annual Electric Power Industry Report" database, as published in the EIA *Electric Sales and Revenue*, are used to calculate physical unit prices. The prices for the residential and

industrial sectors are based directly on the database. Commercial sector prices are calculated as the commercial sector revenues plus the non-transportation portion of "Other" revenues divided by the commercial sales plus the non-transportation portion of "Other" sales. The non-transportation portions of "Other" sales and revenues are estimated using SEDS transportation electricity consumption and the *Electric Sales and Revenue* "Other" sales. The transportation sector prices are based on sales and revenues reported by a non-highway-street-lighting subsector of the "Other" category from the Form EIA-861 database for 1990 through 2000. Transportation electricity prices for 2001 and 2002 are calculated by applying the percentage change in the commercial sector prices between the previous year and the current year to the previous year's transportation sector price.

Transportation electricity prices for Massachusetts and New Jersey in 2000 are out of range and are replaced with prices calculated by applying the percentage change in the commercial sector 1999 and 2000 prices to the 1999 transportation sector price.

Physical unit prices: 1987 through 1989

For 1987 through 1989, state physical unit prices are calculated for all four sectors as the average revenue per kilowatthour of sales by all electric power retailers reporting sales to a state. Revenue and sales data are from the EIA *Electric Power Annual* data files.

The prices for the residential and industrial sectors are based on residential revenues and sales, and industrial revenues and sales, respectively. Commercial sector prices are calculated as the commercial sector revenues plus the non-transportation portion of "Other" revenues divided by the commercial sales plus the non-transportation portion of "Other" sales. The non-transportation portions of "Other" sales and revenues are estimated using SEDS transportation electricity consumption and the *Electric Sales and Revenue* "Other" sales. The transportation sector prices are calculated by dividing the "Other" category revenues by "Other" sales.

Physical unit prices: 1970 through 1986

For 1970 through 1986, preliminary physical unit prices for states are

cal-culated for all four sectors as the average revenue per unit of sales by all electric power facilities reporting sales to a state. The calculation of physical prices is based upon the revenues and sales data from the *Statistical Yearbook* for each year in the series. Data for the residential sector and industrial sector are drawn from their respective columns. The commercial sector is the sum of the columns titled "Commercial," "Street and Highway Lighting," "Other Public Authorities," and "Interdepartmental." The transportation sector is the column titled "Railroads and Railways."

For 1980 through 1986, prices are based on preliminary revenues and sales data in the given year and are replaced with revised data in the following year. The only exception to this rule is the revenues data for AR in 1981; preliminary data are used in this case because of an apparent error in the revised data.

For 1970 through 1981, MD prices are assigned to DC. There are no other missing prices for the residential, commercial, and industrial sectors.

In the transportation sector, many price assignments are made due to the lack of sector-specific price data. Generally, electricity usage in the transportation sector is small; the sector's electricity use ranged from 0.1% to 0.2% of total U.S. electricity consumption in 1970 through 1986. From 1970 through 1986, only 15 states used measurable amounts of electricity in the transportation sector (CA, DC, FL, GA, IL, LA, MA, MD, NJ, NY, OH, PA, TN, VA, and WA). A few individual state prices are unavailable and are assigned the commercial sector prices: LA for 1970 through 1986 and TN for 1970 through 1986. (Prices are available for LA in 1970, 1972, 1973, but those prices are replaced by commercial sector prices to maintain a consistent series for the state.) In addition, MA transportation prices for 1985 and 1986 are estimated by multiplying the MA 1985 and 1986 commercial prices by the average of the ratios of the commercial-to-transportation sector prices for 1980 through 1984. Similarly, the VA 1977 transportation price is estimated by multiplying the VA commercial price in 1977 by the average of the ratios of the commercial-to-transportation sectors prices for 1978 through 1982.

To reconcile national-level electricity prices based on the *Statistical Yearbook* with the EIA national-level electricity prices published in the *Annual Energy Review* (AER), yearly adjustment factors are calculated for the residential, commercial, and industrial sectors as follows: a preliminary U.S. price for each sector is calculated as the average of the state prices, weighted by SEDS consumption. These preliminary U.S. prices are divided by the national-level electricity prices published in the AER, and the quotient is used as an adjustment factor. The preliminary state prices are multiplied by the adjustment factor to produce the final

Table TN6.1. Annual electricity price adjustment factors, 1970 through 1986

Year	Residential	Commercial	Industrial
1970	1.05121	1.05712	1.06832
1971	1.05632	1.05926	1.05504
1972	1.05271	1.05514	1.05765
1973	1.06626	1.06188	1.05991
1974	1.09572	1.08098	1.08732
1975	1.09257	1.08098	1.08732
1976	1.07753	1.07755	1.06891
1977	1.06746	1.07675	1.06820
1978	1.06654	1.08273	1.06861
1979	1.06986	1.08349	1.06441
1980	1.04457	1.06109	1.06781
1981	1.05821	1.06943	1.06523
1982	1.06654	1.06351	1.05597
1983	1.05421	1.05301	1.05537
1984	0.99693	1.01924	0.99015
1985	1.00010	1.02008	0.98355
1986	0.99854	1.01518	0.98618

Data Source: EIA calculations based on data from the *Annual Energy Review* and the *Statistical Yearbook of the Electric Utility Industry*.

physical unit state prices in those sectors. Because no transportation sector prices are published in the AER, no adjustments are made to that sector and the final physical unit prices are derived solely from the *Statistical Yearbook* sales and revenue data. The annual adjustment factors for the residential, commercial, and industrial sectors are shown in Table TN6.1.

Btu prices: all years

SEDS calculates electricity Btu prices by converting the physical unit price series, in dollars per kilowatthour, to dollars per million Btu using the conversion factor 3,412 Btu per kilowatthour. The U.S. Btu prices are the average of the state Btu prices, weighted by SEDS consumption data that have been adjusted for process fuel consumption in the industrial sector.

Data sources
Prices
1990 forward: Electricity sales to ultimate customers and revenue data

from EIA, as shown in the detailed state data spreadsheets of the *Electric Power Annual*, "Electricity Sales to Ultimate Customers by State by Sector by Provider (EIA-861)" and "Revenue from Electricity Sales to Ultimate Customers by State by Sector by Provider (EIA-861)" at http://www.eia.gov/electricity/data/state/, sector category "Total Electric Industry."

Transportation sector variations:

- 2003 forward: Column labeled "Transportation."
- 2001 and 2002: Prices calculated by EIA.
- 1990 through 2000: Data for non-highway lighting portion of "Other" from the Form EIA-861 database files.
- 1987 through 1989: EIA, *Electric Power Annual 1988*, Tables 19 and 21 (1987 data); *Electric Power Annual*, Tables 27 and 29 (1988 and 1989).

1970 through 1986: Edison Electric Institute (EEI), *Statistical Yearbook of the Electric Utility Industry*, tables titled "Revenues: Total Electric Utility Industry" and "Energy Sales: Total Electric Utility Industry," based on EEI surveys.

1970 through 1986: EIA, *Annual Energy Review 1989*, Table 95, "Retail Prices of Electricity Sold by Electric Utilities, 1960-1989."

Consumption

1970 forward: EIA, State Energy Data System, electricity consumption by end-use sector.

Conversion factor: all years

3,412 Btu per kilowatthour.

Nuclear fuel for generation of electricity

The State Energy Data System (SEDS) develops nuclear fuel prices for the electric power sector. SEDS uses its estimates of electricity generated from nuclear power to calculate expenditures of nuclear fuel.

In the United States, there are two types of nuclear power plants: those that are operated by electric utilities and those that are operated by independent power producers. Each year, regulated electric utility power plants report fuel costs to the Federal Energy Regulatory Commission (FERC). These costs include all taxes, transportation, and handling costs. Independent power plants do not need to report fuel costs to FERC. These costs are estimated by EIA or third-party data sources. Occasionally, the fuel costs at nuclear power plants include small amounts of non-nuclear fuels that are necessary to continue essential plant operations during refueling or maintenance of the reactor.

SEDS estimates state-level nuclear fuel prices in two steps. First, SEDS calculates the total cost of fuels consumed at the plant level as the product of the plant's reported or estimated fuel cost by its net electricity generation. Second, SEDS calculates the total fuel costs at the state level as the sum of all plant costs in a state divided by the sum of their net electricity generation.

SEDS uses the methods described below to estimate prices when there are no plant-level data or, in earlier years, not enough data available to calculate average nuclear fuel prices for a state.

Physical unit prices: 2009 forward

For 2009 forward, SEDS uses the fuel costs of regulated nuclear power plants submitted to FERC, extracted from the power plant dataset maintained by S&P Global Market Intelligence (previously maintained by SNL Financial), to calculate the annual average fuel costs per megawatthour for pressurized water reactors (PWR) and boiling water reactors (BWR). For plants with no reported fuel cost, SEDS calculates a total fuel cost estimate as the product of the U.S. average PWR or BWR fuel cost and its net generation. SEDS sums the plant-level total fuel costs and net generation data to the state level and calculates the average nuclear fuel prices using the method described above.

Physical unit prices: 2007 and 2008

For 2007 and 2008, a complete set of plant-level net electricity generation and nuclear fuel cost estimates is provided by EIA, Office of Electricity,

Renewables, and Uranium Statistics (ERUS) and former Office of Coal, Nuclear, Electric, and Alternate Fuels (CNEAF), extracted from Ventyx Velocity Suite.

Physical unit prices: 2001 through 2006

For 2001 through 2006, when a state has nuclear electricity generation in SEDS, but no fuel cost data are available, a state average physical unit price is estimated by CNEAF, generally based on the average physical unit prices paid by the same type(s) of reactors in other states. For 2001-2004, in states where there are nuclear electricity generation and fuel cost data available for only some plants, only those plants with available data are used to calculate the state average price. Occasionally, a plant is excluded from the state price calculation because the cost data are significantly out of range with other plants in the state. The specific states and years with price assignments different than what is outlined above are shown with their price source in Table TN6.2.

Physical unit prices: 1992 through 2000

For 1992 through 2000, in states where there are nuclear electricity generation and fuel cost data for some plants, but not all, available data are used to calculate the state average price. In states where nuclear electricity generation for a specific plant is not available, the plant's fuel cost data also are excluded from the state price calculation. In addition, plants that have no fuel cost data available are excluded from the state price calculation because the cost data are significantly out of range with other plants in the state.

Remaining states with missing cost data are assigned prices using one of the following methods: directly assigning a nearby state or the U.S. price; applying the ratio of the previous year to the current year physical unit nuclear fuel prices for a nearby state to the state's physical unit nuclear fuel price for the previous year; or, assigning the state's average price of the preceding and subsequent year.

When a state has nuclear electricity generation in SEDS, but no fuel cost data are available, the national physical unit nuclear fuel price is used to estimate the state price. The ratio of the current year to the previous year national nuclear fuel price is applied to the state's physical unit nuclear fuel price for the previous year. The national prices used in the estimation are the national averages before missing state prices are assigned.

The states and years estimated using these methodologies are shown in Table TN6.3.

Table TN6.2. Nuclear electricity fuel price estimates, 2001 through 2006

State	Years	Price source
IA	2006	EIA estimate based on 2001–2005 trend of cost decline
IL	2003	Average of 2002 and 2004 Quad Cities cost
	2005, 2006	Quad Cities costs assigned to all plants
MD	2005, 2006	St. Lucie costs assigned
MI	2005	Calvert Cliffs costs assigned
NJ	2002–2004	National year-to-year change
	2005	Oyster Creek assigned St. Lucie costs
	2006	Oyster Creek and Hope Creek assigned St. Lucie costs; Salem assigned Callaway costs
NY	2001	Average of Ginna and Nine Mile Point costs
	2002, 2003	Ginna costs assigned
OH	2006	Davis-Besse assigned Perry costs
PA	2005	Susquehanna and Limerick assigned Beaver Valley costs; Three Mile Island assigned Oconee costs
	2006	Susquehanna, Limerick, and Peach Bottom assigned Beaver Valley costs; Three Mile Island asigned average of Oconee, Crystal River, and Arkansas Nuclear One costs
TX	2005, 2006	Commanche assigned South Texas costs
WI	2006	Kewaunee assigned average price increase of Point Beach and Prairie Island

Physical unit prices: 1970 through 1991

For 1970 through 1991, when a state has nuclear electricity generation in SEDS, but no fuel cost data are available, the national physical unit nuclear fuel price is used to estimate the state price. The ratio of the current year to the previous year national nuclear fuel price is applied to the state's physical unit nuclear fuel price for the previous year. The national prices used in the estimation are the national averages before missing state prices are assigned. The states and years with specific price assignments are shown in Table TN6.3.

Btu prices: all years

SEDS converts nuclear fuel prices from physical unit prices, in dollars per kilowatthour, to dollars per million Btu using the annual nuclear conversion factors listed in SEDS consumption technical notes, Appendix Table B1. SEDS calculates U.S. prices as the average of the state Btu prices, weighted by SEDS consumption data.

Table TN6.3. Nuclear electricity fuel price estimates, 1970 through 2000

State	Years	Price source
AL	1973, 1974, 1976	National year-to-year change
AR	1980	National year-to-year change
AZ	1985	National year-to-year change
CO	1977, 1978, 1982–1984,	
	1986–1989	National year-to-year change
	1985	Assigned zero
CT	1997	Assigned zero
	1998	NH
FL	1997	Excludes Crystal River
GA	1974, 1978	National year-to-year change
	2000	Average of 1999 and 2001
IL	1997	Excludes LaSalle, Zion, and Clinton
	1998	Excludes LaSalle and Clinton
	2000	Excludes Clinton
ME	1972	National year-to-year change
	1997	Assigned zero
MA	1999, 2000	VT
MI	1997	Excludes Big Rock Point
	1998, 1999	Excludes Cook
	2000	Excludes Palisades
MS	1984	National year-to-year change
MO	1984, 1985	National year-to-year change
NC	1982	National year-to-year change
NE	1999, 2000	IA
NJ	2000	Excludes Oyster Creek
NY	1998	Excludes Indian Point 2
OH	1986	National year-to-year change
OR	1975, 1993	Assigned zero
PA	1999	Excludes Three-Mile Island
	2000	Average of Beaver Valley and Peach Bottom
SC	1970	National year-to-year change
	1985	Adjusted for Catawba expenses
TN	1980, 1986, 1987	Assigned zero
WA	1970–1987	U.S.
WI	1970	National year-to-year change

Additional notes

- Nuclear electricity generation levels are negative for Colorado in 1985, Tennessee in 1986 and 1987, Oregon in 1993, and Connecticut in 1997, indicating that the nuclear power plants used more energy than they supplied. In these cases, the fuel prices and expenditures are set to zero.
- For Missouri in 1985, a large credit resulting from litigation is assigned to fuel costs, creating an artificially low price. The 1986 Missouri price, which is in the range of the prices of other nuclear fuel plants, is used to estimate the 1985 price by applying the ratio of the 1985-to-1986 national prices.
- The 1985 U.S. Energy Information Administration (EIA) *Historical Plant Costs and Annual Production Expenses for Selected Electric Plants* has a footnote for the Duke Power Catawba plant in South Carolina stating that the reported production expenses represent only 12.5% of the actual production expenses. The production expenses used in the calculation for the Catawba plant are adjusted accordingly.

Data sources

Prices

2009 forward: EIA, based on data collected on FERC Form 1, "Annual Report of Major Electric Utilities, Licensees, and Others," extracted from S&P Global Market Intelligence power plant dataset (previously SNL Financial power plant dataset).

2007 and 2008: EIA, Office of Electricity, Renewables, and Uranium Statistics (ERUS) and former Office of Coal, Nuclear, Electric, and Alternate Fuels (CNEAF), from estimates compiled by Ventyx Velocity Suite, based on data collected on FERC Form 1, "Annual Report of Major Electric Utilities, Licensees, and Others."

2004 through 2006: EIA, CNEAF, from data published in *NuclearFuel*, (a division of Platts, a McGraw-Hill Company). The data are collected on FERC Form 1, "Annual Report of Major Electric Utilities, Licensees, and Others."

2000 through 2003: EIA, CNEAF, from data published in *Nucleonics Week*, (a division of Platts, a McGraw-Hill Company). The data are collected on FERC Form 1, "Annual Report of Major Electric Utilities, Licensees, and Others."

1997 through 1999: EIA, CNEAF, from data published in *Nucleonics*

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Week, (a division of Platts, a McGraw-Hill Company). The data are collected on FERC Form 1, "Annual Report of Major Electric Utilities, Licensees, and Others," and Form EIA-412, "Annual Report of Public Electric Utilities," http://www.eia.gov/electricity/data/eia412/.

1992 through 1996: EIA, CNEAF, from data compiled by the Utility Data Institute, (a McGraw-Hill Company). The data are collected on FERC Form 1, "Annual Report of Major Electric Utilities, Licensees, and Others," and Form EIA-412, "Annual Report of Public Electric Utilities," http://www.eia.gov/electricity/data/eia412/.

1988 through 1991: EIA, *Electric Plant Cost and Power Production Expenses*, Table 16 (1988-1990) and Table 14 (1991).

1982 through 1987: EIA, *Historical Plant Costs and Annual Production Expenses for Selected Electric Plants*, Table 18 (1982-1984) and Table 20 (1985-1987).

1979 through 1981: EIA, *Thermal Electric Plant Construction Cost and Annual Production Expenses*, pages 267-279 (1979), Table 11 (1980 and 1981).

1975 through 1978: EIA, *Steam Electric Plant Construction Cost and Annual Production Expenses*, "Section II-Nuclear Plants."

1970 through 1974: Federal Power Commission, *Steam Electric Plant Construction Costs and Annual Production Expenses*, data sheets for Nuclear Plants (1970-1973), and "Section II-Nuclear Plants" (1974).

Consumption

1970 forward: EIA, State Energy Data System, electricity generated by nuclear power.

Conversion factors

1985 forward: EIA, annual U.S. average factors calculated using the heat rate reported on Form EIA-860, "Annual Electric Generator Report" (and predecessor forms), and the generation reported on Form EIA-923, "Power Plant Operations Report" (and predecessor forms). The factors are published in the State Energy Data consumption technical notes, Appendix Table B1, http://www.eia.gov/state/seds/seds-technical-notes-complete.php.

1970 through 1984: EIA, annual U.S. average factors calculated by dividing the total heat content consumed in nuclear generating units by the total (net) electricity generated by those nuclear generating units. The heat content and electricity generation are reported on Form FERC-

1 and Form EIA-412, and predecessor forms.

Electricity imports and exports

The State Energy Data System (SEDS) includes electricity transmitted across U.S. borders with Canada and Mexico in the electric power sector. Quantities and value of U.S. electricity imports and exports are available in the foreign trade statistics published by the U.S. Department of Commerce, Census Bureau. SEDS uses the annual U.S. total imports and exports quantities and revenues to calculate U.S. annual average prices. SEDS uses the U.S. prices for any state with electricity trade. For 1989 forward, SEDS converts the physical unit prices, in dollars per megawatthour, to Btu prices in dollars per million Btu using the factor of 3,412 Btu per kilowatthour. Imports and exports quantity and revenue data are not available for calculating prices for 1970 through 1988. SEDS estimates prices for those years by applying annual industrial sector electricity price percent change to the 1989 U.S. average electricity imports and exports prices.

Data sources

Prices

1989 forward: U.S. Department of Commerce, Census Bureau, general import and domestic export data, SITC Number 35100, extracted from the U.S. International Trade Commission's DataWeb, http://dataweb.usitc.gov.

1970 through 1988: EIA, State Energy Data System, industrial sector electricity prices.

Consumption

1970 forward: EIA, State Energy Data System, electricity imports and electricity exports.

Conversion factor, all years

3,412 Btu per kilowatthour.