

Section 6. Electricity

This section describes electrical energy sources; electricity consumed by end users (i.e., electricity sold to end users); estimates of the electrical system energy losses incurred in the generation, transmission, and distribution of electricity; and estimates of net interstate sales of electricity.

Electrical Energy Sources

Physical Units

Electricity is produced from a number of energy sources. In the Combined State Energy Data System (CSEDS), coal, natural gas, and petroleum are measured in physical units of thousand short tons, million cubic feet, and thousand barrels, respectively, as they are consumed by the electric utilities. Because comparable measures in physical units for nuclear power, hydroelectric, wood, waste, geothermal, wind, photovoltaic, and solar thermal energy sources are not available, energy output in the form of electricity produced from these energy sources, in million kilowatthours, is used instead. The variable names for these data are as follows ("ZZ" in the variable name represents the two-letter State code that differs for each State):

CLEUPZZ = coal consumed by electric utilities (described in Section 2 of this report), in thousand short tons;
 ELEXPZZ = electricity exported from the United States (assumed to be produced from hydroelectric power through 1988), in million kilowatthours;
 ELIMPZZ = electricity imported into the United States (assumed to be produced from hydroelectric power through 1988), in million kilowatthours;

GEEOPZZ = electricity produced from geothermal energy at electric utilities (described in Section 5), in million kilowatthours;
 GEIMPZZ = electricity produced from geothermal energy and imported into the United States (described in Section 5), in million kilowatthours;
 HPEOPZZ = electricity produced from pumped storage hydroelectric power at electric utilities (described in Section 5), in million kilowatthours;
 HVEOPZZ = electricity produced from conventional hydroelectric power at electric utilities (described in Section 5), in million kilowatthours;
 HYEXPZZ = electricity produced from hydroelectric power and exported from the United States (described in Section 5), in million kilowatthours;
 HYIMPZZ = electricity produced from hydroelectric power and imported into the United States (described in Section 5), in million kilowatthours;
 NGEUPZZ = natural gas consumed by electric utilities (described in Section 3), in million cubic feet;
 NUATPZZ = electricity produced from nuclear power by nonutility power producers, in million kilowatthours;
 NUEOPZZ = electricity produced from nuclear power at electric utilities, in million kilowatthours;
 PAEUPZZ = petroleum consumed by electric utilities (described in Section 4), in thousand barrels;
 SOEOPZZ = electricity produced from photovoltaic and solar thermal energy sources at electric utilities (described in Section 5), in million kilowatthours;
 WDEOPZZ = electricity produced from wood energy sources at electric utilities (described in Section 5), in million kilowatthours;
 WSEOPZZ = electricity produced from waste energy sources at electric utilities (described in Section 5), in million kilowatthours; and

WYEPZZ = electricity produced from wind energy at electric utilities (described in Section 5), in million kilowatthours.

The U.S. totals for these series are calculated as the sum of the State data, with the exception of coal, which is the sum of the U.S. totals for each rank of coal as described in Section 2.

British Thermal Units (Btu)

In order to total all the energy that is used to produce electricity, the energy sources are converted to the common unit of Btu. The methods for calculating the Btu content of coal, natural gas, petroleum, and renewable energy sources consumed by utilities are explained in their respective sections of this documentation. Nuclear electric power is described in the following section.

A total of all energy input at electric utilities, including imports and exports of electricity across U.S. borders, is calculated by the following formulas for each State and for the United States:

$$\begin{aligned} \text{TEEUBZZ} &= \text{PAEUBZZ} + \text{NGEUBZZ} + \text{CLEUBZZ} + \text{HYENBZZ} + \\ &\quad \text{NUEOBZZ} + \text{GEENBZZ} + \text{WWEUBZZ} + \text{WNEOBZZ} \\ &\quad + \text{EXNIBZZ} \\ \text{TEEUBUS} &= \Sigma \text{TEEUBZZ} \end{aligned}$$

Nuclear Electric Power

CSEDS contains estimates of electricity generated from nuclear power at electric utilities and by nonutility power producers. Electric utilities nuclear electricity is shown in the “Nuclear Electric Power” column of tables titled, “Estimates of Energy Input at Electric Utilities.” The nonutilities nuclear electricity generation is a component of the “Other” column in the tables titled, “Industrial Energy Consumption Estimates.” Total electricity generated from nuclear power is the sum of nuclear-electric power generated at electric utilities and by nonutility power producers:

$$\text{NUETPZZ} = \text{NUEOPZZ} + \text{NUATPZZ}$$

$$\text{NUETPUS} = \Sigma \text{NUETPZZ}$$

The factor for converting electricity produced from nuclear energy (NUEOKUS) is developed from data collected from nuclear steam-electric power plants. These U.S. average factors, which vary from year to year, can be found in Appendix C, Table C1.

NUEOKUS = factor for converting nuclear electricity from kilowatthours to Btu.

The formulas for applying the nuclear factor are:

$$\begin{aligned} \text{NUEOBZZ} &= \text{NUEOPZZ} * \text{NUEOKUS} \\ \text{NUEOBUS} &= \Sigma \text{NUEOBZZ} \end{aligned}$$

$$\begin{aligned} \text{NUATBZZ} &= \text{NUATPZZ} * \text{NUEOKUS} \\ \text{NUATBUS} &= \Sigma \text{NUATBZZ} \end{aligned}$$

$$\begin{aligned} \text{NUETBZZ} &= \text{NUEOBZZ} + \text{NUATBZZ} \\ \text{NUETBUS} &= \Sigma \text{NUETBZZ} \end{aligned}$$

Data Sources

NUATPZZ — Electricity generated from nuclear energy by nonutility power producers.

- 1960 through 1988: No data available. Values assumed to be zero.
- 1989 forward: EIA, data from the Form EIA-860B, “Annual Electric Generator Report – Nonutility,” database as published for 1998 and 1999 in the EIA *Electric Power Annual, Volume I*, Table A11.

NUEOKUS — Factor for converting electricity produced from nuclear power from physical units to Btu.

- 1960 through 1991: Calculated annually by EIA by dividing the total heat content consumed in reactors at nuclear plants by the total (net) electricity generated by nuclear plants. The heat content and electricity generation are reported on FERC Form 1, “Annual Report of Major Electric Utilities, Licensees, and Others;” Form EIA-412, “Annual Report of Public Electric Utilities;” and predecessor forms. The factors for 1982 through 1991 are published in the following:

- 1982: EIA, *Historical Plant Cost and Annual Production Expenses for Selected Electric Plants 1982*, page 215.
- 1983 through 1991: EIA, *Electric Plant Cost and Power Production Expenses 1991*, Table 13.
- 1992 forward: Calculated annually by EIA by dividing the total heat content of the steam leaving nuclear generating units to generate electricity by the total (net) electricity generated by nuclear generating units. The heat content and electricity generation data are reported in the Nuclear Regulatory Commission, *Licensed Operating Reactors—Status Summary Report*.

NUEOPZZ — Electricity produced from nuclear power at electric utilities by State.

- 1960 through 1977: Federal Power Commission, News Release, “Power Production, Fuel Consumption, and Installed Capacity Data,” table titled “Net Generation of Electric Utilities by State and Source.”
- 1978 through 1980: EIA, *Energy Data Reports*, “Power Production, Fuel Consumption and Installed Capacity Data;” 1978: table titled “Net Generation of Electric Utilities by State and Source;” 1979 and 1980: Table 36.
- 1981 through 1985: EIA, Form EIA-759, “Monthly Power Plant Report,” and predecessor forms. Data are published in the EIA, *Electric Power Annual 1985*, Table 6.
- 1986 forward: EIA, Form EIA-759, “Monthly Power Plant Report,” and predecessor forms. Data are published in the EIA *Electric Power Annual*. Data are from the report of the following year., i.e., 1986 final data are published in the *Electric Power Annual, 1987*. The specific tables are:
 - 1986: Table 19.
 - 1987: Table 10.
 - 1988 and 1989: Table 14.
 - 1990 through 1993: Table 13.
 - 1994 forward: *Volume I*, Table 10.
 - 1997: *Volume I*, Table A2.
 - 1998 and 1999: *Volume I*, Table A11.

Electricity Imports and Exports

Imports and exports of electricity across U.S. borders prior to 1989 are assumed to be based on hydroelectric power. Beginning with 1989, traded electricity is identified in CSEDS as derived from hydroelectric power, geothermal energy, or nonrenewable energy sources. Electricity imports and exports based on renewable energy sources are discussed in more detail in the Renewables section of this documentation on pages 406 and 408. Renewable-based electricity imports and exports are summed in million kilowatthours and billion Btu and identified with “ER” as the source code in the variable name:

EREXPZZ = HYEXPZZ
 EREXPUS = Σ EREXPZZ
 ERIMPZZ = HYIMPZZ + GEIMPZZ
 ERIMPUS = Σ ERIMPZZ

EREXBZZ = HYEXBZZ
 EREXBUS = Σ EREXBZZ
 ERIMBZZ = HYIMBZZ + GEIMBZZ
 ERIMBUS = Σ ERIMBZZ

Imports and exports of electricity produced from nonrenewable energy sources (“EX”), in million kilowatthours, are calculated by subtracting renewable-based imports and exports from total electricity imports and exports :

EXIMPZZ = ELIMPZZ – ERIMPZZ
 EXIMPUS = Σ EXIMPZZ
 EXEXPZZ = ELEXPPZZ – EREXPZZ
 EXEXPUS = Σ EXEXPZZ

Nonrenewable-based electricity imports and exports are converted from million kilowatthours to billion Btu by using a conversion factor that is the U.S. average heat content of fossil fuels consumed at steam-electric power plants (FFEOKUS). The annual values for this factor are shown in Appendix C, Table C1.

EXIMBZZ = EXIMPZZ * FFEOKUS
 EXIMBUS = Σ EXIMBZZ

Table A8. Net Imports of Electricity Produced from Nonrenewable Energy Sources, 1989–1999
(Trillion Btu)

State	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Alabama	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Alaska	0.000	0.004	0.002	0.002	0.003	0.004	0.003	0.004	0.006	0.004	0.005
Arizona	0.000	-0.022	1.110	-0.022	-0.023	-0.026	3.464	-0.027	0.125	-0.019	0.000
Arkansas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
California	20.792	23.353	15.498	11.676	11.077	8.041	8.472	4.141	2.698	4.205	5.874
Colorado	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.165	0.004	0.009
Connecticut	0.494	0.162	1.864	2.668	2.354	3.478	4.000	4.086	6.512	4.943	5.805
Delaware	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dist. of Col.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Florida	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Georgia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hawaii	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Idaho	0.062	0.470	0.501	0.778	0.000	0.199	0.009	0.525	0.650	0.523	0.098
Illinois	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Indiana	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Iowa	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.633	-0.046	-0.158
Kansas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.013	-0.077
Kentucky	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Louisiana	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Maine	5.642	9.146	3.995	2.253	3.079	8.917	14.213	13.022	13.106	20.119	18.916
Maryland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Massachusetts	4.468	8.497	7.912	4.907	4.025	4.522	5.611	4.905	7.139	4.943	5.805
Michigan	0.029	-113.809	-5.405	-3.009	4.998	20.366	17.757	4.288	-7.792	-29.687	-8.064
Minnesota	4.363	-2.847	8.024	15.704	9.738	22.002	25.392	25.391	37.113	21.073	15.753
Mississippi	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Missouri	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.004	-0.001	0.012
Montana	0.039	0.206	0.086	0.048	0.003	-0.002	-0.004	0.115	0.021	0.052	-0.294
Nebraska	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	-0.701	-0.605
Nevada	0.156	0.009	0.028	0.007	0.002	0.020	0.000	0.000	0.000	0.000	0.000
New Hampshire	0.401	0.162	1.864	2.668	2.354	3.478	4.000	4.086	6.512	4.943	5.805
New Jersey	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
New Mexico	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
New York	13.554	-15.329	9.200	5.503	10.334	36.296	27.150	18.376	-3.817	-8.491	-10.558
North Carolina	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
North Dakota	0.541	-1.285	-0.064	1.942	0.448	1.952	1.901	2.242	-0.539	-3.597	-2.838
Ohio	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oklahoma	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oregon	4.623	3.770	4.590	2.574	2.366	3.145	2.594	8.551	2.960	1.316	0.093
Pennsylvania	0.000	0.000	0.000	0.000	0.000	0.417	(s)	0.558	0.431	-1.770	-0.257
Rhode Island	0.207	0.162	1.864	2.668	2.354	3.478	4.000	4.086	6.512	4.943	5.805
South Carolina	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
South Dakota	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.297	-0.462	0.581
Tennessee	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Texas	0.014	-0.660	-4.663	-17.061	-8.258	-9.952	-9.542	-10.589	-9.372	-8.013	-11.149
Utah	(s)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.109	0.005	0.000
Vermont	4.971	6.971	3.628	1.179	1.629	5.709	9.236	8.752	14.445	11.752	26.682
Virginia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Washington	6.706	1.238	9.080	18.464	3.941	29.121	2.769	16.247	27.586	24.243	33.798
West Virginia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Wisconsin	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.504	3.366	2.618	1.507
Wyoming	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
United States	67.063	-79.799	59.113	52.945	50.424	141.163	121.024	109.261	108.874	52.911	92.552

(s)=Number less than 0.0005.
Source: Combined State Energy Data System 1999.

EXEXBZZ = EXEXPZZ * FFEOKUS
EXEXBUS = ΣEXEXBZZ

Net imports of electricity produced from nonrenewable energy sources is calculated by subtracting exports from imports:

EXNIPZZ = EXIMPZZ - EXEXPZZ
EXNIPUS = ΣEXNIPZZ
EXNIBZZ = EXIMBZZ - EXEXBZZ
EXNIBUS = ΣEXNIBZZ

Net imports of nonrenewable-based electricity are included in the "Total" column of *SEDR* tables titled "Energy Consumption Estimates by Source" and "Estimates of Energy Input at Electric Utilities" but are not shown separately in the tables' columns. Table A8 provides the data by State and year.

Total imports and exports of electricity are calculated in billion Btu by summing the renewable and nonrenewable components:

ELIMBZZ = HYIMBZZ + GEIMBZZ + EXIMBZZ
ELIMBUS = ΣELIMBZZ
ELEXBZZ = HYEXBZZ + EXEXBZZ
ELEXBUS = ΣELEXBZZ

Data Sources

ELEXPZZ — Electricity exported from the United States (assumed to be produced by hydroelectric power through 1988) by State.

- 1960 through 1981: Economic Regulatory Administration, *Staff Reports*, "Report on Electric Energy Exchanges with Canada and Mexico." Source data are arranged by the Regional Reliability Council Areas and then by the electric utility. State data were tabulated by aggregating the data of all electric utilities within each State.

- 1982 and 1983: EIA State estimates are based on data from Economic Regulatory Administration Form ERA-781R, “Annual Report of Electrical Export/Import Data.” State estimates are consistent with national and regional totals published in the ERA, *Electricity Exchanges Across International Borders*.
- 1984 through 1987: EIA State estimates are based on data from Economic Regulatory Administration Form ERA-781R, “Annual Report of Electrical Export/Import Data,” the Federal Energy Regulatory Commission Form 1, and the Bonneville Power Administration Annual Report. State estimates are consistent with national and regional totals published in the ERA, *Electricity Transactions Across International Borders*.
- 1988 forward: EIA State estimates are based on data from DOE, Fossil Fuels, Fuels Programs, Office of Coal and Electricity, Form FE-781R, “Annual Report of International Electrical Export/Import Data,” and predecessor forms, and the Canada National Energy Board report, “Electricity Exports and Imports, Monthly Statistics for December....”

ELIMPZZ — Electricity imported into the United States (assumed to be produced by hydroelectric power through 1988) by State.

- 1960 through 1981: Economic Regulatory Administration, *Staff Reports*, “Report on Electric Energy Exchanges with Canada and Mexico.” Source data are arranged by the Regional Reliability Council Areas and then by the electric utility. State data were tabulated by aggregating the data of all electric utilities within each State.
- 1982 and 1983: EIA State estimates are based on data from Economic Regulatory Administration Form ERA-781R, “Annual Report of Electrical Export/Import Data.” State estimates are consistent with national and regional totals published in the ERA, *Electricity Exchanges Across International Borders*.
- 1984 through 1987: EIA State estimates are based on data from Economic Regulatory Administration Form ERA-781R, “Annual Report of Electrical Export/Import Data,” the Federal Energy Regulatory Commission Form 1, and the Bonneville Power Administration Annual Report. State estimates are consistent with national and regional totals published in the ERA, *Electricity Transactions Across International Borders*.

- 1988 forward: EIA State estimates are based on data from DOE, Fossil Fuels, Fuels Programs, Office of Coal and Electricity, Form FE-781R, “Annual Report of International Electrical Export/Import Data,” and predecessor forms, and the Canada National Energy Board report, “Electricity Exports and Imports, Monthly Statistics for December....”

FFEOKUS — Fossil fuel steam-electric power plant conversion factor.

- 1960 through 1988: Estimated by EIA as the weighted annual average heat rate for fossil-fueled steam-electric plants in the United States as published in the EIA, *Electric Plant Cost and Power Production Expenses 1991*, Table 9.
- 1989 forward: Calculated annually by EIA on the basis of data from Form EIA-767 “Steam-Electric Plant Operation and Design Report.”

Electricity Consumed by the End User

Physical Units

The amount of electricity sold to end users is considered to be the amount of electricity consumed by the end-use sectors. Five electricity sales data series, in physical units of million kilowatthours, are used to estimate consumption of electricity by end-use sector:

- ESRCPZZ = electricity sold to the residential sector of each State;
- ESCMPZZ = a portion of the electricity sold to the commercial sector of each State;
- ESICPZZ = electricity sold to the industrial sector of each State;
- ESOTPZZ = electricity sold to “Other” users (i.e., public street and highway lighting, other public authorities, railroads and railways, and interdepartmental sales) in each State; and
- ESTRPZZ = electricity consumed by transit systems, in each State.

U.S. totals for the five State-level series are calculated as the sum of the State data.

The sales of electricity to the residential and industrial sectors are used directly as consumption of electricity by these sectors.

Electricity consumed by transit systems in each State is assumed to be the total electricity used for transportation:

$$\begin{aligned} \text{ESACPZZ} &= \text{ESTRPZZ} \\ \text{ESACPUS} &= \Sigma \text{ESACPZZ} \end{aligned}$$

The commercial sector consumption of electricity, represented by ESCCPZZ, is estimated as the sum of sales to the commercial sector and the portion of sales to the "Other" sector that is not used for transportation:

$$\begin{aligned} \text{ESCCPZZ} &= \text{ESCMPZZ} + \text{ESOTPZZ} - \text{ESACPZZ} \\ \text{ESCCPUS} &= \Sigma \text{ESCCPZZ} \end{aligned}$$

Total electricity consumed by the major end-use sectors is represented by ESTCPZZ and is calculated by adding the four major sector estimates:

$$\begin{aligned} \text{ESTCPZZ} &= \text{ESRCPZZ} + \text{ESCCPZZ} + \text{ESICPZZ} + \text{ESACPZZ} \\ \text{ESTCPUS} &= \Sigma \text{ESTCPZZ} \end{aligned}$$

British Thermal Units (Btu)

Electricity consumption estimates are converted into Btu by applying a constant factor of 3.412 thousand Btu per kilowatthour as illustrated in the formulas:

$$\begin{aligned} \text{ESRCBZZ} &= \text{ESRCPZZ} * 3.412 \\ \text{ESTCBZZ} &= \text{ESTCPZZ} * 3.412 \end{aligned}$$

And U.S. totals in Btu are calculated by summing the States' Btu values.

Additional Calculations

Additional calculations are performed in CSEDS to provide data for the EIA *Monthly Energy Review* and *Annual Energy Review*. The share of electricity sold to the "Other" category of consumers that is used for transportation is calculated:

$$\text{ESTRSUS} = \text{ESACPUS} / \text{ESOTPUS}$$

Data Sources

ESCMPZZ — A portion of the electricity sold to the commercial sector by State.

Note: Data for Maryland and the District of Columbia were combined for 1960 through 1983. The method for disaggregating the data is explained in Note 3 on page 430.

- 1960 through 1975: Federal Power Commission, *Electric Power Statistics*, "Sales of Electric Energy to Ultimate Consumers."
- 1976 through 1980: EIA, *Electric Power Annual* (November 1982), Table 125.
- 1981 through 1983: EIA, Form EIA-826, "Electric Utility Company Monthly Statement," and predecessor forms. Published data rounded to gigawatthours in EIA, *Electric Power Annual 1983*, Table 51.
- 1984 through 1986: EIA, Form EIA-861, "Annual Electric Utility Report." Unpublished data.
- 1987: EIA, Form EIA-861, "Annual Electric Utility Report." Published in the EIA, *Electric Power Annual 1988*, Table 19.
- 1988 forward: EIA, Form EIA-861, "Annual Electric Utility Report." Published in the following reports:
 - 1988 through 1990: EIA, *Electric Power Annual*, Table 27.
 - 1991 through 1998: EIA, *Electric Sales and Revenue*, Table 15.
 - 1999: EIA, *Electric Sales and Revenue*, Sum of sales by electric utilities shown in Table 15, and sales in deregulated markets shown in Table C2.

ESICPZZ — Electricity consumed by the industrial sector by State.

Note: Data for Maryland and the District of Columbia were combined for 1960 through 1983. The method for disaggregating the data is explained in Appendix A, Note 3, on page 430.

- 1960 through 1975: Federal Power Commission, *Electric Power Statistics*, "Sales of Electric Energy to Ultimate Consumers."
- 1976 through 1980: EIA, *Electric Power Annual* (November 1982), Table 126.
- 1981 through 1983: EIA, Form EIA-826, "Electric Utility Company Monthly Statement," and predecessor forms. Published data rounded to gigawatthours in EIA, *Electric Power Annual 1983*, Table 51.
- 1984 through 1986: EIA, Form EIA-861, "Annual Electric Utility Report." Unpublished data.
- 1987: EIA, Form EIA-861, "Annual Electric Utility Report." Published in the EIA, *Electric Power Annual 1988*, Table 19.

- 1988 forward: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the following reports:
 - 1988 through 1990: EIA, *Electric Power Annual*, Table 27.
 - 1991 through 1998: EIA, *Electric Sales and Revenue*, Table 16.
 - 1999: EIA, *Electric Sales and Revenue*, Sum of sales by electric utilities shown in Table 16, and sales in deregulated markets shown in Table C2.

ESOTPZZ — Electricity sold to the “Other” sector (i.e., public street and highway lighting, sales to other public authorities, railroads and railways, and interdepartmental sales) by State.

Note: Data for Maryland and the District of Columbia were combined for 1960 through 1983. The method for disaggregating the data is explained in Appendix A, Note 3, on page 430.

- 1960 through 1975: Federal Power Commission, *Electric Power Statistics*, “Sales of Electric Energy to Ultimate Consumers.”
- 1976 through 1980: EIA, *Electric Power Annual* (November 1982), Table 127.
- 1981 through 1983: EIA, Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Published data rounded to gigawatthours in EIA, *Electric Power Annual 1983*, Table 51.
- 1984 through 1986: EIA, Form EIA-861, “Annual Electric Utility Report.” Unpublished data.
- 1987: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual 1988*, Table 19.
- 1988 forward: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the following reports:
 - 1988 through 1990: EIA, *Electric Power Annual*, Table 27.
 - 1991 forward: EIA, *Electric Sales and Revenue*, Table 6.
 - 1999: EIA, *Electric Sales and Revenue*, Sum of sales by electric utilities shown in Table 6, and sales in deregulated markets from the Form EIA-861 database.

ESRCPZZ — Electricity consumed by the residential sector by State.

Note: Data for Maryland and the District of Columbia were combined for 1960 through 1983. The method for disaggregating the data is explained in Appendix A, Note 3, on page 430.

- 1960 through 1975: Federal Power Commission, *Electric Power Statistics*, “Sales of Electric Energy to Ultimate Consumers.”

- 1976 through 1980: EIA, *Electric Power Annual* (November 1982), Table 124.
- 1981 through 1983: EIA, Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Published data rounded to gigawatthours in EIA, *Electric Power Annual 1983*, Table 51.
- 1984 through 1986: EIA, Form EIA-861, “Annual Electric Utility Report.” Unpublished data.
- 1987: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual 1988*, Table 19.
- 1988 forward: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the following reports:
 - 1988 through 1990: *Electric Power Annual*, Table 27.
 - 1991 through 1998: EIA, *Electric Sales and Revenue*, Table 14.
 - 1999: EIA, *Electric Sales and Revenue*, Sum of sales by electric utilities shown in Table 14, and sales in deregulated markets shown in Table C2.

ESTRPZZ — Electricity consumed by transit systems by State.

Notes: The transit system data include electricity used to operate commuter rail, rapid rail, streetcars or light rail, cable cars, trolley-buses, motorbuses, automated guideways, inclined plane railways, and aerial tramways. These data do not include electricity used by Amtrak. These data are available on a fiscal year basis (July 1 through June 30) for 1979 through 1982 and for calendar years 1983 forward. Some data for 1979 through 1983 were adjusted by EIA on the basis of an analysis of historical trends. Electricity consumption for the District of Columbia for 1976 forward is partially apportioned to Maryland and Virginia on the basis of electricity consumption data from the Washington Metropolitan Area Transit Authority.

- 1960 through 1978: EIA estimates are based on data from:
 - The American Public Transit Association (formerly the American Transit Association) annual operating reports.
 - Pushkarev, Boris S. and others, *Urban Rail in America*. (Bloomington, IN: Indiana University Press, 1982.)
 - U.S. Department of Transportation, *A Directory of Regularly Scheduled, Fixed Route, Local Public Transportation Service in Urbanized Areas Over 50,000 Population*, 1980 and 1981.
- 1979 through 1989: U.S. Department of Transportation, Urban Mass Transportation Administration, *National Urban Mass Transportation Statistics, Section 15 Annual Report*, table titled “Energy Consumption: Details by Transit System.”

- 1979 and 1980: Table 2.13.1.
- 1981 and 1982: Table 3.13.1.
- 1983 through 1989: Table 3.12.
- 1990 forward: U.S. Department of Transportation, Federal Transit Administration, *Data Tables for the Section 15 Report Year*.
 - 1990: Table 2.12.
 - 1991: Table 13.
 - 1992 through 1997: Table 15.
 - 1998: Table 16
 - 1999: Table 17
- Data for 1996 forward are also available via the Internet at <http://www.ntdprogram.com>. Click on “Publications/Data” and then “Data Tables.”

Estimates of Electrical System Energy Losses

British Thermal Units (Btu)

Electrical system energy losses, identified by “LO,” include all losses incurred in the generation, transmission, and distribution of electricity, including plant use and unaccounted for quantities. Total losses for the United States, LOTCBUS, is assumed to be the difference between the total of all energy input at electric utilities (TEEUBUS) and the total electricity sold to end users (ESTCBUS). Total losses for the United States is calculated in billion Btu as follows:

$$\text{LOTCBUS} = \text{TEEUBUS} - \text{ESTCBUS}$$

Because Alaska and Hawaii have no exchanges of electricity with other States, their electrical system energy losses are estimated as the difference between the sum of all energy input at the State’s electric utilities and the electricity sold within the State:

$$\begin{aligned} \text{LOTGBAK} &= \text{TEEUBAK} - \text{ESTGBAK} \\ \text{LOTGBHI} &= \text{TEEUBHI} - \text{ESTGBHI} \end{aligned}$$

Individual State electrical system energy losses for the remaining States are estimated by a different method. The difference between each of the contiguous 48 States’ (including the District of Columbia) TEEUB series and ESTCB is not only the losses but also any net interstate flow of electricity that may occur between States. In some cases these net interstate flows are substantial. Therefore, an effort is made to estimate separately each State’s losses and net interstate flow. The methodology is to calculate the contiguous-48-State subtotal of losses and subtotal of sales; to create annual losses-to-sales ratios for the aggregate of the 48 States; and to apply the annual losses-to-sales ratios from the total 48 States to the individual 48 States’ sales to estimate their losses.

The following steps are performed to complete the losses estimates. A subtotal of losses in the contiguous 48 States, LOTCB48, is created by subtracting the Alaska and Hawaii losses from the total United States’ losses:

$$\text{LOTCB48} = \text{LOTCBUS} - (\text{LOTGBAK} + \text{LOTGBHI})$$

A similar subtotal of electricity sales in the 48 States only, ESTCB48, is calculated:

$$\text{ESTCB48} = \text{ESTCBUS} - (\text{ESTGBAK} + \text{ESTGBHI})$$

The losses-to-sales ratio for the contiguous 48 States only, ELLSS48, is calculated:

$$\text{ELLSS48} = \text{LOTCB48} / \text{ESTCB48}$$

Over the 40-year period now covered in CSEDS, the ratio is fairly constant, with a slight downward trend. For 1960, the ratio is 2.5; for 1961 through 1983 the ratio is 2.4; for 1984 through 1988 the ratio is 2.3; for 1989 through 1991 it is 2.2; and for 1992 forward the losses-to-sales ratio is 2.1. The decline in the ratio in recent years is attributed partially to the fact that electricity produced by nonutility power producers is included in the electricity sales data, while the resources consumed to produce the nonutility electricity are not included in the energy input. When the electricity purchased by utilities from nonutilities is subtracted from the electricity sales, the ratio is 2.3 for 1989 through 1993, and 2.2 for 1994 forward.

The U.S. ratios are applied to each State's sales to the major end-use sectors and total sales (temporarily including Alaska, Hawaii, and the 48-State subtotal for processing convenience):

$$\begin{aligned} \text{LORCBZZ} &= \text{ESRCBZZ} * \text{ELLSS48} \\ \text{LOCCBZZ} &= \text{ESCCBZZ} * \text{ELLSS48} \\ \text{LOICBZZ} &= \text{ESICBZZ} * \text{ELLSS48} \\ \text{LOACBZZ} &= \text{ESACBZZ} * \text{ELLSS48} \\ \text{LOT CBZZ} &= \text{ESTCBZZ} * \text{ELLSS48} \end{aligned}$$

Alaska, Hawaii, and the contiguous 48-State subtotal are recalculated to their original estimates. The end-use losses for Alaska and Hawaii are created in proportion to each sector's share of the State's total electricity sales:

$$\begin{aligned} \text{LOT CBAK} &= \text{TEEUBAK} - \text{ESTCBAK} \\ \text{LOT CBHI} &= \text{TEEUBHI} - \text{ESTCBHI} \\ \text{LOT CB48} &= \text{LOT CBUS} - (\text{LOT CBAK} + \text{LOT CBHI}) \end{aligned}$$

$$\begin{aligned} \text{LOR CBAK(HI)} &= (\text{ESRCBAK(HI)} / \text{ESTCBAK(HI)}) * \text{LOT CBAK(HI)} \\ \text{LOCCBAK(HI)} &= (\text{ESCCBAK(HI)} / \text{ESTCBAK(HI)}) * \text{LOT CBAK(HI)} \\ \text{LOICBAK(HI)} &= (\text{ESICBAK(HI)} / \text{ESTCBAK(HI)}) * \text{LOT CBAK(HI)} \\ \text{LOACBAK(HI)} &= (\text{ESACBAK(HI)} / \text{ESTCBAK(HI)}) * \text{LOT CBAK(HI)} \end{aligned}$$

Losses for the United States, including Alaska and Hawaii, are the sums of all the States' losses.

Physical Units

Estimates of losses in physical units of million kilowatthours are made by dividing the Btu estimate by the constant 3.412 thousand Btu per kilowatt-hour as illustrated in the following formulas:

$$\begin{aligned} \text{LORCPZZ} &= \text{LORCBZZ}/3.412 & \text{LORCPUS} &= \text{LORCBUS}/3.412 \\ \text{LOTCPZZ} &= \text{LOT CBZZ}/3.412 & \text{LOTCPUS} &= \text{LOT CBUS}/3.412 \end{aligned}$$

Net Interstate Flow of Electricity

British Thermal Units (Btu)

An estimate of the net interstate flow of electricity is calculated as the difference between the total electricity sales and attributed losses and the total energy input to the electric utilities within each State. The estimated net interstate flow of electricity (ELISB) for each State and the United States is calculated:

$$\begin{aligned} \text{ELISBZZ} &= (\text{ESTCBZZ} + \text{LOT CBZZ}) - \text{TEEUBZZ} \\ \text{ELISBUS} &= \Sigma \text{ELISBZZ} \end{aligned}$$

Physical Units

Estimates of net interstate flow of electricity in physical units of million kilowatthours are calculated by dividing the Btu value by the constant 3.412 thousand Btu per kilowatt-hour:

$$\begin{aligned} \text{ELISPZZ} &= \text{ELISBZZ} / 3.412 \\ \text{ELISPUS} &= \Sigma \text{ELISPZZ} \end{aligned}$$

Positive net interstate flow for a State means that the amount consumed within the State (including attributed losses) is greater than the amount of energy input at electric utilities in the State. That is, the State is using more electricity than it generates and, therefore, is a net buyer from other States.

A negative number indicates that the State's input into its electric utilities is greater than the requirements for electricity within its own borders, and, therefore, it is a net seller of electricity to other States.

Additional Notes on Electricity

1. The source for the electricity sales data for 1960 through 1983 is the Energy Information Administration (EIA) Form EIA-826, "Electric Utility Company Monthly Statement," and predecessor forms. Electricity sales data for 1984 forward are from Form EIA-861, "Annual

Electric Utility Report.” At the national level, data from both forms correspond closely (within 3 percent) for all end-use sectors. However, differences in the number of survey respondents and the reporting of commercial and industrial sales caused inconsistencies between 1983 and 1984 data in those end-use sectors for some States. See the EIA’s, *Electric Power Annual, 1991*, DOE/EIA-0348(91), p. 130, and *An Assessment of the Quality of Selected EIA Data Series, Electric Power Data*, DOE/EIA-0292(87), pp. 17–28, for detailed discussions of the reporting differences.

2. The source for the electricity sales data for 1960 through 1983 is the EIA Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Electricity sales data for the District of Columbia and Maryland are combined on those forms. Estimates of

separate sales for the District of Columbia and Maryland were created by using electricity sales data by end-use sector by communities from the FERC Form 1, “Annual Report of Major Electric Utilities, Licensees, and Others,” filed by the Potomac Electric Power Company (PEPCO). PEPCO sales to the District of Columbia were assumed to be total electricity sales in the District of Columbia. Electricity sales to the District of Columbia reported by PEPCO on the FERC Form 1 were subtracted from the EIA-826 District of Columbia and Maryland aggregate figures to obtain estimates of Maryland electricity sales by sector. Beginning with 1981 data, electric utilities were no longer required to report sales to specific communities. Therefore, sales data for the District of Columbia for 1981 through 1983 were obtained directly from PEPCO’s accounting department.