

Section 4. Petroleum

Petroleum Overview

At the national level, consumption of each petroleum product is assumed to equal “product supplied.” Product supplied measures the disappearance of petroleum products from primary sources, i.e., refineries, natural gas-processing plants, blending plants, pipelines, and bulk terminals. In general, product supplied of each product in any given period is computed as follows: field production, plus refinery production, plus imports, plus unaccounted-for crude oil minus stock change, minus crude oil losses, minus refinery inputs, and minus exports.

Data on state-level product supplied by sector are not available. The methods of estimating consumption by state and sector are discussed in the individual subsections.

The 25 petroleum products included in the State Energy Data System (SEDS) are explained in this section. For 10 of these products, the means of estimating their consumption by state is described in individual sections. The 10 petroleum products are:

- asphalt and road oil (AR)
- aviation gasoline (AV)
- distillate fuel oil (DF)
- jet fuel (JF)
- kerosene (KS)
- liquefied petroleum gases (LG)
- lubricants (LU)
- motor gasoline (MG)
- petroleum coke (PC)
- residual fuel oil (RF)

The remaining 15 products are described in the section “Other Petroleum Products” and include the following:

- crude oil, including lease condensate (CO)
- miscellaneous petroleum products (MS)
- natural gasoline (NA) (including isopentane)
- petrochemical feedstocks, naphtha less than 401°F (FN)
- petrochemical feedstocks, other oils equal to or greater than 401°F

(FO)

- petrochemical feedstocks, still gas (FS)
- plant condensate (PL)
- pentanes plus (PP)
- special naphthas (SN)
- still gas (SG)
- unfractionated streams (US)
- waxes (WX)
- unfinished oils (UO)
- motor gasoline blending components (MB)
- aviation gasoline blending components (AB)

The last petroleum documentation section, “Petroleum Summaries,” describes how the 25 petroleum products are combined for each major end-use sector’s estimated consumption.

Table TN4.1 summarizes the petroleum products’ end-use assignments in SEDS. Shown in this table are the first four letters of the seven-letter variable names used to identify all energy sources. The first two letters identify the petroleum product and the next two letters identify the end-use sector. For example, the table shows that the aviation gasoline estimated to be consumed by the transportation sector is all aviation gasoline consumed, and that there is some estimated consumption of lubricants in the industrial and transportation sectors, while distillate fuel oil is consumed in every sector.

Table TN4.1. Summary of petroleum products in the State Energy Data System

Petroleum products	Residential sector estimated consumption (RC)		Commercial sector estimated consumption (CC)		Industrial sector estimated consumption (IC)		Transportation sector estimated consumption (AC)		Electric power sector estimated consumption (EI)	Total sector estimated consumption (TC)	
Asphalt and road oil (AR)					ARIC				=	ARTC	
					+					+	
Aviation gasoline (AV)							AVAC		=	AVTC	
							+			+	
Distillate fuel oil (DF)	DFRC	+	DFCC	+	DFIC	+	DFAC	+	DFEI	=	DFTC
	+		+		+		+		+	+	
Jet fuel (JF)							JFAC		JFEU	=	JFTC
							+			+	
Kerosene (KS)	KSRC	+	KSCC	+	KSIC					=	KSTC
	+		+		+					+	
Liquefied petroleum gases (LG)	LGRC	+	LGCC	+	LGIC	+	LGAC			=	LGTC
					+		+			+	
Lubricants (LU)			+		LUIC		LUAC			=	LUTC
					+		+			+	
Motor gasoline (MG)			MGCC		MGIC		MGAC			=	MGTC
			+		+		+			+	
Residual fuel oil (RF)			RFCC		RFIC	+	RFAC	+	RFEI	=	RFTC
					+				+	+	
Other petroleum products (PO)			PCCC ¹	+	POIC ²		+		PCEI ¹	=	POTC
Total petroleum (PA)	PARC	+	PACC	+	PAIC	+	PAAC	+	PAEI	=	PATC

¹ "Other petroleum products" are consumed in the industrial sector with the exception of petroleum coke consumed by the commercial and electric power sectors.

² "Other petroleum products" consumed by the industrial sector comprises crude oil, including lease condensate; unfinished oils; plant condensate; aviation gasoline and motor gasoline blending components; natural gasoline; petrochemical feedstocks (naphtha less than 401°F, other oils equal to or greater than 401°F, and still gas); pentanes plus; special naphthas; still gas; unfractionated streams; waxes; miscellaneous petroleum products; and petroleum coke for industrial use.

Asphalt and Road Oil

Physical units

There are no state-level consumption data for asphalt and road oil available. Before 2009, state-level sales data are used to apportion national-level consumption numbers to the states. From 2009 forward, state-level production of hot-mix asphalt and warm-mix asphalt, excluding reclaimed asphalt pavement, are used to allocate national-level consumption to the states.

The asphalt and road oil sales and production data are in short tons, while the consumption data are in thousand barrels. Because the tonnage data are used only to apportion the U.S. consumption data to the states, they do not need to be converted into thousand barrels.

The five data series that are used to estimate consumption of asphalt and road oil are (where “ZZ” in the variable name represents the two-letter state code that differs for each state):

ASINPZZ	=	asphalt sold for use in the industrial sector of each state, in short tons (through 2008);
ASPRPZZ	=	asphalt (hot-mix and warm-mix) production excluding reclaimed asphalt pavement in each state, in short tons (for 2009 forward);
ASTCPUS	=	asphalt total consumed in the United States, in thousand barrels (includes road oil from 1983 forward);
RDINPZZ	=	road oil sold for use in the industrial sector of each state, in short tons (no data from 1983 forward); and
RDTCPUS	=	road oil total consumed in the United States, in thousand barrels (no data from 1983 forward).

Consumption of all asphalt and road oil is assigned to the industrial sector because asphalt and road oil are mostly used in construction activity. ASTCPUS represents total U.S. consumption of asphalt, and RDTCPUS represents total U.S. consumption of road oil. Both are the “product supplied” data series in the publication *Petroleum Supply Annual*, published by the U.S. Energy Information Administration (EIA). Beginning in 1983, asphalt product supplied includes road oil, and RDTCPUS is entered as zero in SEDS.

Before 2009, state-level asphalt sales data are used to allocate the U.S. consumption value to the states. ASINPZZ represents all asphalt sold as paving products, as roofing products, and for all other uses. RDINPZZ represents all sales of road oil. These data are collected and published by

the Department of Interior (1960–1977), EIA (1978–1980), and the Asphalt Institute (1981–2008). Values for RDINPZZ for 1981 and 1982 are estimated as described under “Additional Notes” in this section. Beginning with 1983 data, when road oil is included in asphalt product supplied data, RDINPZZ is entered as zero in SEDS.

To calculate state consumption estimates of asphalt, total sales of asphalt and road oil in the United States to the industrial sector are first calculated as the sum of the state data:

$$\begin{aligned} \text{ASINPUS} &= \sum \text{ASINPZZ} \\ \text{RDINPUS} &= \sum \text{RDINPZZ} \end{aligned}$$

Each state’s consumption of asphalt in the industrial sector (ASICPZZ) is calculated to be in proportion to each state’s sales:

$$\begin{aligned} \text{ASICPZZ} &= (\text{ASINPZZ} / \text{ASINPUS}) * \text{ASTCPUS} \\ \text{ASICPUS} &= \sum \text{ASICPZZ} \\ \text{RDICPZZ} &= (\text{RDINPZZ} / \text{RDINPUS}) * \text{RDTCPUS} \\ \text{RDICPUS} &= \sum \text{RDICPZZ} \end{aligned}$$

Beginning in 2009, state-level asphalt sales data are no longer available from the Asphalt Institute. To estimate state-level consumption, state-level production of hot-mix asphalt and warm-mix asphalt (HMA/WMA) excluding reclaimed asphalt pavement (RAP), ASPRPZZ, is used to allocate U.S. consumption to the states. These data are gathered from the National Asphalt Pavement Association (NAPA). HMA/WMA is used by the paving industry and contains about five percent asphalt binder, the petroleum product measured in SEDS. The use of recycled materials reduces the need of asphalt binder. Hence RAP tonnage is removed from HMA/WMA tonnage to derive the state allocators. While estimates of HMA/WMA tonnage are available from the source for all states, RAP estimates are withheld for some states and are estimated in SEDS.

$$\text{ASPRPUS} = \sum \text{ASPRPZZ}$$

Each state’s consumption of asphalt in the industrial sector (ASICPZZ) is calculated to be in proportion to each state’s HMA/WMA production:

$$\begin{aligned} \text{ASICPZZ} &= (\text{ASPRPZZ} / \text{ASPRPUS}) * \text{ASTCPUS} \\ \text{ASICPUS} &= \sum \text{ASICPZZ} \end{aligned}$$

Since all asphalt and road oil are assumed to be used in the industrial sector, their total consumption in each state equals the industrial sector consumption:

$$\text{ASTCPZZ} = \text{ASICPZZ}$$

$$\text{RDTCPZZ} = \text{RDICPZZ}$$

Asphalt and road oil consumption are added together:

$$\begin{aligned}\text{ARICPZZ} &= \text{ASICPZZ} + \text{RDICPZZ} \\ \text{ARICPUS} &= \Sigma \text{ARICPZZ} \\ \text{ARTCPZZ} &= \text{ASTCPZZ} + \text{RDTCPZZ} \\ \text{ARTCPUS} &= \Sigma \text{ARTCPZZ}\end{aligned}$$

British thermal units (Btu)

Asphalt and road oil have a heat content value of approximately 6.636 million Btu per barrel. This factor is applied to convert asphalt and road oil estimated consumption from physical units to Btu:

$$\begin{aligned}\text{ARICBZZ} &= \text{ARICPZZ} * 6.636 \\ \text{ARICBUS} &= \Sigma \text{ARICBZZ}\end{aligned}$$

Because all asphalt and road oil are assumed to be used by the industrial sector, total asphalt and road oil consumption in each state and in the United States is assumed to equal the industrial sector consumption:

$$\begin{aligned}\text{ARTCBZZ} &= \text{ARICBZZ} \\ \text{ARTCBUS} &= \text{ARICBUS}\end{aligned}$$

Additional notes

The federal government stopped collecting asphalt and road oil sales data after 1980. For 1981 through 2008, the source for these numbers was the Asphalt Institute. When companies did not respond to the voluntary survey, the Asphalt Institute did not estimate quantities to compensate for the nonresponse. This could cause large fluctuation in sales from year to year for some states.

For most years through 2008, asphalt and road oil sales data for Maryland and the District of Columbia are published combined to avoid disclosure of proprietary data. Prior to being entered into SEDS, the combined data are allocated to each state based on their reported sales in 1974. In this allocation procedure 99.4% is allocated to Maryland and 0.6% to the District of Columbia.

The EIA report series "Sales of Asphalt," and predecessor reports, which are the source for road oil sales by state (RDINPZZ) in SEDS for 1960 through 1980, was discontinued after the 1980 report. For 1981 and 1982, state estimates of road oil sales were created by first converting the annual total

U.S. road oil product supplied data into short tons (one short ton contains 5.5 barrels of road oil). Then, the U.S. total road oil product supplied, in short tons, was disaggregated to each state in proportion to the state's share of total U.S. asphalt sales as reported in the Asphalt Institute's *Report on Sales of Asphalt in the U.S.*

Data sources

ASINPZZ — Asphalt sold to the industrial sector by state.

- 1960 through 1977: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Sales of Asphalt," the specific tables are:
 - 1960 through 1962: Table 6.
 - 1963 through 1977: Table 5.
- 1978 through 1980: EIA, *Energy Data Reports*, "Sales of Asphalt," Table 2.
- 1981 through 1986: The Asphalt Institute, *Asphalt Usage 1987 United States and Canada*, Table B.
- 1987 and 1988: The Asphalt Institute, *Asphalt Usage 1988 United States and Canada*, Tables A and B for state data. *Asphalt Usage 1989 United States and Canada*, page 2 for revised U.S. totals. The Asphalt Institute did not publish corresponding revised state data but did advise EIA on an estimation procedure to adjust 19 state values to sum to the revised U.S. totals.
- 1989 through 1997: The Asphalt Institute, *Asphalt Usage United States and Canada*, table titled "U.S. Asphalt Usage."
- 1998 and 1999: The Asphalt Institute, *Asphalt Usage United States and Canada*, table titled "1998 vs. 1999 U.S. Asphalt Usage." 1998 data for Delaware, New Hampshire, Rhode Island, and Vermont are repeated for 1999 because nonresponse to the survey caused those states data for 1999 to be more than 75% lower than their 1998 values.
- 2000 through 2008: The Asphalt Institute, <http://www.asphaltinstitute.org/>, *Asphalt Usage Survey for the United States and Canada*, table titled "U.S. Asphalt Usage."

ASPRPZZ — Hot-mix asphalt and warm-mix asphalt production excluding reclaimed asphalt pavement by state.

- 2009 forward: *Annual Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage*, <http://www.asphaltpavement.org/recycling>.

ASTCPUS — Asphalt total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Petroleum Statement, Annual,” Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, “Petroleum Statement, Annual,” Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled “Products Supplied.” The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

RDINPZZ — Road oil sold to the industrial sector by state.

- 1960 through 1977: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Sales of Asphalt.” The specific tables are:
 - 1960 through 1962: Table 6.
 - 1963 through 1977: Table 5.
- 1978 through 1980: EIA, *Energy Data Reports*, “Sales of Asphalt,” Table 2.
- 1981 and 1982: EIA estimates. (See explanation in “Additional Notes” on page 32.)
- 1983 forward: Road oil is included in asphalt data. Value entered in SEDS as zero.

RDTCBUS — Road oil total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Petroleum Statement, Annual,” Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, “Petroleum Statement, Annual,” Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 2.
- 1983 forward: Road oil is included in asphalt data. Value entered in SEDS as zero.

Aviation Gasoline

Physical units

The three data series used to estimate consumption of aviation gasoline are:

AVMIPZZ	=	aviation gasoline issued to the military in each state, in thousand barrels;
AVNMMZZ	=	aviation gasoline sold to nonmilitary users in each state, in thousand gallons; and
AVTCPUS	=	aviation gasoline total consumed in the United States, in thousand barrels.

The U.S. Department of Transportation, Federal Highway Administration publishes the nonmilitary aviation gasoline sales data by state (AVNMMZZ) in *Highway Statistics*.

AVMIPZZ is the issues of aviation gasoline to the military in each state and is obtained from the U.S. Department of Defense, Defense Logistics Agency.

Total U.S. consumption of aviation gasoline (AVTCPUS) is the product supplied data series in the publication *Petroleum Supply Annual*, published by the U.S. Energy Information Administration (EIA).

The state-level data series are summed to provide totals for the United States:

AVMIPUS	=	Σ AVMIPZZ
AVNMMUS	=	Σ AVNMMZZ

The state sales of nonmilitary aviation gasoline data are converted from thousand gallons to thousand barrels (42 gallons = 1 barrel):

AVNMPZZ	=	$\text{AVNMMZZ} / 42$
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The U.S. nonmilitary sales is the sum of the states’ sales:

AVNMPUS	=	Σ AVNMPZZ
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The total sales of aviation gasoline is estimated as the sum of nonmilitary sales and military issues:

AVTTPZZ	=	$\text{AVNMPZZ} + \text{AVMIPZZ}$
AVTTPUS	=	Σ AVTTPZZ

All aviation gasoline is assumed to be used by the transportation sector. An estimate of aviation gasoline consumption by the transportation sector

by state (AVACPZZ) is calculated by assuming that each state consumes aviation gasoline in proportion to the amount sold to that state:

$$\begin{aligned} \text{AVACPZZ} &= (\text{AVTTPZZ} / \text{AVTTPUS}) * \text{AVTCPUS} \\ \text{AVACPUS} &= \Sigma \text{AVACPZZ} \end{aligned}$$

Total aviation gasoline consumption in each state, AVTCPZZ, equals the transportation sector consumption in each state:

$$\text{AVTCPZZ} = \text{AVACPZZ}$$

British thermal units (Btu)

Aviation gasoline has a heat content value of approximately 5.048 million Btu per barrel. This factor is applied to convert aviation gasoline estimated consumption from physical units to Btu:

$$\begin{aligned} \text{AVACBZZ} &= \text{AVACPZZ} * 5.048 \\ \text{AVACBUS} &= \Sigma \text{AVACBZZ} \end{aligned}$$

Because all aviation gasoline is assumed to be used for transportation, aviation gasoline total consumption in each state and in the United States equals the transportation sector consumption:

$$\begin{aligned} \text{AVTCBZZ} &= \text{AVACBZZ} \\ \text{AVTCBUS} &= \Sigma \text{AVTCBZZ} \end{aligned}$$

Additional note

In 2015, the Federal Highway Administration has revised its methods of estimating aviation gasoline use. Estimates from 2015 forward are not compatible with data before 2015.

Data sources

AVMIPZZ — Aviation fuel issued to the military in the United States by state.

- 1960 through 1974: No data are available. The 1977 data are used for each year.
- 1975 and 1976: No consistent data series are available. The 1977 data are used for both years.
- 1977 through 1988: U.S. Department of Defense, Defense Logistics Agency, Defense Fuel Supply Center, Defense Energy Information System, military retail issues based on fiscal year data. The District of Columbia issues are assumed to be zero; therefore, values reported for

the District of Columbia are added to Maryland.

- 1989 and 1990: U.S. Department of Defense, Defense Logistics Agency, Defense Fuel Supply Center. State data for the fiscal year from two databases are summed: Defense Fuel Automated Management System (military wholesale issues) and Into-Plane Database (military purchases from commercial airports). Into-plane values reported for the District of Columbia are added to Virginia.
- 1991 through 2003: U.S. Department of Defense, Defense Logistics Agency, Defense Energy Supply Center. State data for the calendar year from two databases are summed: Defense Fuel Automated Management System (military wholesale issues) and Into-Plane Database (military purchases from commercial airports). Into-plane values reported for the District of Columbia are added to Virginia.
- 2004 forward: U.S. Department of Defense, Defense Logistics Agency Energy. State data for product 130, Aviation Gasoline, Grade 100LL, by calendar year were used.

AVNMMZZ — Aviation gasoline sold to nonmilitary users by state.

- 1960 through 1964: U.S. Department of Commerce, Bureau of Public Roads, *Highway Statistics*, Table G-24.
- 1965 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table G-24 (1965), Table MF-24 (1966 through 2006), and Table 8.4.3 (2007 forward).

AVTCPUS — Aviation gasoline total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Distillate Fuel Oil

Physical units

Since state-level and end-use consumption data for distillate fuel oil (except for that consumed by the electric power sector) are not available, sales of distillate fuel oil into or within each state, published by the U.S. Energy Information Administration (EIA) in the *Fuel Oil and Kerosene Sales Report*, are used to estimate distillate fuel oil consumption. The following variable names have been assigned to the sales series, in thousand barrels ("ZZ" in the variable names represents the two-letter state code that differs for each state):

DFBKPZZ	=	distillate fuel oil sales for vessel bunkering use (i.e., the fueling of commercial or private boats, such as pleasure craft, fishing boats, tugboats, and ocean-going vessels, including vessels operated by oil companies, and fueling for other marine purposes), excluding that sold to the military;
DFCMPZZ	=	distillate fuel oil sales to commercial establishments for space heating, water heating, and cooking;
DFIBPZZ	=	distillate fuel oil sales to industrial establishments for space heating and for other industrial use (i.e., for all uses to mines, smelters, plants engaged in producing manufactured products, in processing goods, and in assembling), including farm use;
DFMIPZZ	=	distillate fuel oil sales to the military, for all uses;
DFOCPZZ	=	distillate fuel oil sales for oil company use, including all fuel oil, crude oil, or acid sludge used as fuel at refineries, by pipelines, or in field operations;
DFOFPZZ	=	distillate fuel oil sales as diesel fuel for off-highway use in construction (i.e., earthmoving equipment, cranes, stationary generators, air compressors, etc.) and for off-highway uses other than construction (i.e., logging);
DFONPZZ	=	distillate fuel oil sales as diesel fuel for on-highway use (i.e., as engine fuel for trucks, buses, and automobiles);
DFOTPZZ	=	distillate fuel oil sales for all other uses not identified in other sales categories;
DFRRPZZ	=	distillate fuel oil sales to the railroads for use in fueling trains, operating railroad equipment, space heating of buildings, and other operations; and

DFRSPZZ = distillate fuel oil sales to the residential sector for space heating, water heating, and cooking, excluding farm houses.

Three additional data series are used in calculating distillate fuel oil consumption estimates:

DKEIPZZ	=	distillate fuel oil (including kerosene-type jet fuel before 2001) consumed by the electric power sector, in thousand barrels;
JKEUPZZ	=	kerosene-type jet fuel consumed by electric utilities, in thousand barrels; and
DFTCPUS	=	distillate fuel oil total consumed in the United States, in thousand barrels.

Distillate fuel oil consumed by the electric power sector is collected by EIA on Form EIA-923, "Power Plant Operations Report," and predecessor forms. (See Note 4 at the end of this distillate fuel oil section for further information on changes in this series' data definitions.) Before 2001, the data series DKEIPZZ includes kerosene-type jet fuel consumed at electric utilities that is identified as JKEUPZZ. The kerosene-type jet fuel is subtracted from the distillate fuel oil data and accounted for in the jet fuel data described in a following section of this documentation. Data for kerosene-type jet fuel consumed by electric utilities are available for 1972 through 1982 only. Consumption in all other years is assumed to be zero. From 2001 forward, jet fuel consumed by the electric power sector is grouped under waste/other oil and is not accounted for in SEDS. DKEIPZZ is continued to be used to represent distillate fuel oil consumed by the electric power sector.

Total consumption of distillate fuel oil in the United States, DFTCPUS, is the product supplied series in the EIA publication *Petroleum Supply Annual*. From 2011 forward, product supplied of distillate fuel oil includes all biodiesel blended into distillate fuel oil. Prior to 2011, only the portion of biodiesel that was reported as refinery and blender net input was included.

All of the state-level data series listed above are summed to provide totals for the United States.

Next, the variables are combined as closely as possible into the major end-use sectors used in SEDS. The residential sector sales and the commercial sector sales contain only DFRSPZZ and DFCMPZZ, respectively.

The sales of distillate fuel oil to the industrial sector for each state, DFINPZZ, is the sum of the distillate fuel oil sales for industrial use, including industrial space heating and farm use (DFIBPZZ), for oil company use (DFOCPZZ),

for off-highway use (DFOFPZZ), and for all other uses (DFOTPZZ). Data for DFOTPZZ are available through 1994. Starting in 1995, consumption is assumed to be zero:

$$\begin{aligned}\text{DFINPZZ} &= \text{DFIBPZZ} + \text{DFOCPZZ} + \text{DFOFPZZ} + \text{DFOTPZZ} \\ \text{DFINPUS} &= \Sigma \text{DFINPZZ}\end{aligned}$$

The sales of distillate fuel oil to the transportation sector for each state, DFTRPZZ, is the sum of the distillate fuel oil sales for vessel bunkering, military use, railroad use, and the diesel fuel used on-highway:

$$\begin{aligned}\text{DFTRPZZ} &= \text{DFBKPZZ} + \text{DFMIPZZ} + \text{DFRRPZZ} + \text{DFONPZZ} \\ \text{DFTRPUS} &= \Sigma \text{DFTRPZZ}\end{aligned}$$

Sales of distillate fuel oil to the residential, commercial, industrial, and transportation sectors are added to create a subtotal of sales to all sectors other than the electric utility sector, DFNDPZZ:

$$\begin{aligned}\text{DFNDPZZ} &= \text{DFRSPZZ} + \text{DFCMPZZ} + \text{DFINPZZ} + \text{DFTRPZZ} \\ \text{DFNDPUS} &= \Sigma \text{DFNDPZZ}\end{aligned}$$

For 2001 forward, consumption of distillate fuel oil by the electric power sector (DFEIPZZ) is the same as the input series DKEIPZZ:

$$\text{DFEIPZZ} = \text{DKEIPZZ}$$

Before 2001, DFEIPZZ is calculated by subtracting the kerosene-type jet fuel consumed by electric utilities from DKEIPZZ:

$$\text{DFEIPZZ} = \text{DKEIPZZ} - \text{JKEUPZZ}$$

For all years, the U.S. total for this data series is summed:

$$\text{DFEIPUS} = \Sigma \text{DFEIPZZ}$$

The estimated U.S. distillate fuel oil consumption by all sectors other than the electric power sector, DFNCPUS, is calculated by subtracting the distillate fuel oil consumption by the electric power sector from the total U.S. distillate fuel oil consumption:

$$\text{DFNCPUS} = \text{DFTCPUS} - \text{DFEIPUS}$$

This U.S. subtotal of distillate fuel oil consumption by the four end-use sectors, DFNCPUS, is apportioned to the states by use of the end-use sectors' state-level sales data. The assumption is made that each state consumes distillate fuel oil in proportion to the amount of sales to that state:

$$\text{DFNCPZZ} = (\text{DFNDPZZ} / \text{DFNDPUS}) * \text{DFNCPUS}$$

The end-use sectors' subtotal for each state, DFNCPZZ, is further divided into estimates for the four end-use sectors in proportion to each sector's sales. The estimated residential sector consumption in each state, DFRCPZZ, is calculated:

$$\begin{aligned}\text{DFRCPZZ} &= (\text{DFRSPZZ} / \text{DFNDPZZ}) * \text{DFNCPZZ} \\ \text{DFRCPUS} &= \Sigma \text{DFRCPZZ}\end{aligned}$$

The commercial sector's estimated consumption in each state, DFCCPZZ, is calculated:

$$\begin{aligned}\text{DFCCPZZ} &= (\text{DFCMPZZ} / \text{DFNDPZZ}) * \text{DFNCPZZ} \\ \text{DFCCPUS} &= \Sigma \text{DFCCPZZ}\end{aligned}$$

The industrial sector's estimated consumption in each state, DFICPZZ, is calculated:

$$\begin{aligned}\text{DFICPZZ} &= (\text{DFINPZZ} / \text{DFNDPZZ}) * \text{DFNCPZZ} \\ \text{DFICPUS} &= \Sigma \text{DFICPZZ}\end{aligned}$$

The transportation sector's estimated consumption in each state, DFACPZZ, is calculated:

$$\begin{aligned}\text{DFACPZZ} &= (\text{DFTRPZZ} / \text{DFNDPZZ}) * \text{DFNCPZZ} \\ \text{DFACPUS} &= \Sigma \text{DFACPZZ}\end{aligned}$$

Total state distillate fuel oil consumption is the sum of the end-use sectors' consumption subtotal and the electric power sector consumption:

$$\text{DFTCPZZ} = \text{DFNCPZZ} + \text{DFEIPZZ}$$

British thermal units (Btu)

The factor for converting distillate fuel oil from physical unit values to Btu, DFTCKUS, is calculated annually for 1994 forward by EIA as a consumption-weighted average of the heat contents of three categories of distillate fuel oil based on its sulfur content. DFTCKUS is shown in Table B1 on page 167. For 1960 through 1993, a fixed factor of 5.825 million Btu per barrel is used:

$$\text{DFTCKUS} = \text{factor for converting distillate fuel oil from physical units to Btu.}$$

This factor is applied to convert distillate fuel oil estimated consumption

for the five consuming sectors from physical units to Btu as shown in the following example:

$$\text{DFRCBZZ} = \text{DFRCPZZ} * \text{DFTCKUS}$$

Total Btu consumption of distillate fuel oil is the sum of the consumption by the end-use sectors and for electricity generation:

$$\text{DFTCBZZ} = \text{DFRCBZZ} + \text{DFCCBZZ} + \text{DFICBZZ} + \text{DFACBZZ} + \text{DFEIBZZ}$$

The U.S. Btu consumption estimates are calculated as the sum of all the states' data.

In the SEDS consumption tables, "Estimates of Energy Consumption by the Electric Power Sector," the data used in the column headed "Distillate" is the variable DKEIP, which includes keorsene-type jet fuel before 2001, in physical units. The Btu variable, DKEIB, is calculated as follows (See page 43 for description of JKEUB):

$$\begin{aligned} \text{DKEIBZZ} &= \text{DFEIBZZ} && \text{for 2001 forward} \\ \text{DKEIBZZ} &= \text{DFEIBZZ} + \text{JKEUBZZ} && \text{before 2001} \\ \text{DKEIBUS} &= \Sigma \text{DKEIBZZ} \end{aligned}$$

Additional notes

1. "Deliveries" data are actually called "shipments" in the source document for 1960 and 1961; "consumption" for 1962 through 1966; "shipments" for 1967; "sales" from 1968 through 1978; "deliveries" for 1979 through 1987; and "sales" for 1988 forward.
2. State data for the variables DFONPZZ (on-highway use), DFOFPZZ (off-highway use), and DFOTPZZ (other) for 1967 are unavailable from published sources. These three variables compose the miscellaneous use category for distillate fuel oil, which is known for all years by state. State estimates of DFONPZZ and DFOFPZZ for 1967 were developed by dividing the 1966 values for DFONPZZ and DFOFPZZ by the 1966 total miscellaneous use for each state and applying these percentages to the 1967 total miscellaneous use for each state. The 1967 state estimates for DFOTPZZ are the remainder of the 1967 miscellaneous category after DFONPZZ and DFOFPZZ have been subtracted.
3. In 1979, EIA implemented a new survey form, EIA-172, to obtain deliveries of fuel oil and kerosene data and updated the list of respondents. (A detailed explanation is published in the *Energy Data Report*, "Deliveries of Fuel Oil and Kerosene in 1979.") In this survey form, certain end-use categories were redefined—in many cases to collect more disaggregated

data. The reclassifications resulted in some end-use categories that were no longer comparable with those in previous surveys. Where discontinuities occurred, estimates for the pre-1979 years have been made in the State Energy Data System (SEDS) to conform with the 1979 fuel oil deliveries classifications. The pre-1979 deliveries estimates are not published in this report, but are used in SEDS to disaggregate the known U.S. total product supplied (consumption) into state and major end-use sector consumption estimates.

For distillate fuel oil deliveries in 1979, the end-use categories called "residential," "commercial," "industrial," and "farm" are available. The pre-1979 deliveries categories are called "heating" and "industrial" (which included farm use). While the pre-1979 categories individually are not continuous with the 1979 categories, their subtotals are related. That is, a general comparison can be made between the sum of residential, commercial, industrial, and farm deliveries in 1979 and the sum of heating and industrial deliveries in the pre-1979 years. Therefore, the following method was applied to present a comparable series for distillate fuel oil delivered to the residential, commercial, and industrial sectors:

- For each of the pre-1979 years, a subtotal was created for each state by adding each state's heating and industrial deliveries categories. A comparable 1979 subtotal was created by adding each state's residential, commercial, industrial, and farm deliveries categories.
- Residential, commercial, and industrial (including farm) shares of the subtotal in 1979 were calculated for each state.
- These 1979 end-use shares were then applied to each pre-1979 subtotal of distillate fuel oil deliveries in each state to create state estimates of end-use deliveries for 1960 through 1978.

The 1980 through 1982 distillate fuel oil deliveries data are based on the same survey as that used for 1979; therefore, the 1980 through 1982 data are directly comparable to 1979 data.

In 1984, EIA again updated the list of respondents for this survey, and the Form EIA-172 became the Form EIA-821, "Annual Fuel Oil and Kerosene Sales Report." EIA did not conduct a fuel oil and kerosene deliveries survey for 1983. The 1983 estimates in SEDS are based on 1984 data obtained from the Form EIA-821. Statistical procedures and methodologies used for the Form EIA-821 differ from those used in previous years. Therefore, the 1983 and forward sales data may not be directly comparable to the pre-1983 data. (In the source document, the deliveries data for 1983 forward are reported in thousand gallons. These

data are first converted to thousand barrels before being entered into SEDS.)

Some of the No. 2 diesel fuel reported as sold to the commercial and industrial sectors, DFCMPZZ and DFINPZZ, on the EIA forms may also be included in the on-highway data, DFONPZZ, obtained from the Federal Highway Administration. Included in the commercial sector is some diesel fuel consumed by government vehicles and school buses, and included in the industrial sector is some diesel fuel consumed by fleets of trucks. Because the specific quantities involved are unknown, SEDS reflects the diesel fuel consumption as reported in the EIA *Petroleum Marketing Monthly* and no attempt has been made to adjust the end-use reporting.

4. The data on fuel oil consumed by the electric power sector for all years and states are actual fuel oil consumption numbers collected from electric power plants on Form EIA-923, "Power Plant Operations Report," and predecessor forms. Due to changes in fuel oil reporting classifications on the predecessor forms over the years, it is not possible to develop a thoroughly consistent series for all years. However, over time, data more accurately disaggregating fuel oil into distillate fuel oil and residual fuel oil have become available. For 1960 through 1969, only data on total fuel oil consumed at electric utilities by state are available. For 1970 through 1979, fuel oil consumed by plant type (internal combustion and gas turbine plants combined and steam plants) by state are available. For 1980 through 2000, data on consumption of light fuel oil at all plant types combined and consumption of heavy fuel oil at all plant types combined are available by state. For 2001 forward, data on consumption of distillate fuel oil and residual fuel oil are available. In SEDS, the following assumptions have been made:

- 1960 through 1969—state estimates of fuel oil consumption by plant type have been created for each year by applying the shares of steam plants (primarily residual fuel oil) and internal combustion and gas turbine plants (primarily distillate fuel oil plus small amounts of jet kerosene) by state in 1970 to each year's total fuel oil consumption at electric utilities for 1960 through 1969.
- 1970 through 1979—fuel oil consumed by steam plants is assumed to equal residual fuel oil consumption, and fuel oil consumed by internal combustion and gas turbine plants is assumed to equal distillate fuel oil plus jet kerosene consumption.
- 1980 through 2000—total heavy oil consumption at all plant types is assumed to equal residual fuel oil consumption, and total light oil consumption at all plant types is assumed to equal

distillate fuel oil plus jet kerosene consumption.

The data series thus derived for SEDS for residual fuel oil and distillate fuel oil consumption by the electric power sector is considered to be actual consumption by the electric power for each state and each year.

Data sources

DFBKPZZ — Distillate fuel oil sales for vessel bunkering use by state, excluding that sold to the military.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 and 1961: Table 17.
 - 1962 and 1963: Table 16.
 - 1964 and 1965: Table 15.
 - 1966 through 1975: Table 11.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 11.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VVB_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VVB_Mgal_a.htm.

DFCMPZZ — Distillate fuel oil sales to the commercial sector for space heating, water heating, and cooking.

- 1960 through 1978: EIA estimates based on statistics of commercial sector deliveries of distillate fuel oil from the EIA, *Energy Data Report*, "Deliveries of Fuel Oil and Kerosene in 1979," Table 1. State ratios based on 1979 commercial sector deliveries were applied to each state's sum of heating plus industrial (including farm use) deliveries categories from the fuel oil deliveries reports for each year 1960 through 1978. (See explanation in Note 3, on page 37.)
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and

Kerosene," Table 1.

- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VCS_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VCS_Mgal_a.htm.

DFIBPZZ — Distillate fuel oil sales to industrial establishments for space heating and for other industrial use, including farm use by state.

- 1960 through 1978: EIA estimates based on statistics of industrial sector deliveries of distillate fuel oil from the EIA, *Energy Data Report*, "Deliveries of Fuel Oil and Kerosene in 1979," Table 1. State ratios based on 1979 industrial sector deliveries were applied to each state's sum of heating plus industrial (including farm use) deliveries categories from the fuel oil deliveries reports for each year 1960 through 1978. (See explanation in Note 3, on page 37.)
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_vin_Mgal_a.htm and http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VFM_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VFM_Mgal_a.htm and http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VFM_Mgal_a.htm.

DFMIPZZ — Distillate fuel oil sales to the military for all uses by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 and 1961: Table 18.
 - 1962 and 1963: Table 17.
 - 1964 and 1965: Table 16.
 - 1966 through 1975: Table 12.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 12.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VMI_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VMI_Mgal_a.htm.

DFOCPZZ — Distillate fuel oil sales for use by oil companies by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 and 1961: Table 14.
 - 1962 and 1963: Table 13.
 - 1964 and 1965: Table 12.
 - 1966 through 1975: Table 9.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 9.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.

- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VOC_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VOC_Mgal_a.htm.

DFOFZZ — Distillate fuel oil sales as diesel fuel for off-highway use by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 through 1962: Table 19.
 - 1963 and 1964: Table 18.
 - 1965 through 1967: Table 17.
 - 1968 through 1975: Table 14.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 14.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPD2D_VHF_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPD2D_VHF_Mgal_a.htm.

DFONPZZ — Distillate fuel oil sales as diesel fuel for on-highway use by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 through 1962: Table 19.
 - 1963 and 1964: Table 18.
 - 1965 through 1967: Table 17.
 - 1968 through 1975: Table 14.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and

Kerosene," Table 14.

- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPD2D_VHN_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPD2D_VHN_Mgal_a.htm.

DFOTPZZ — Distillate fuel oil sales for all other uses not identified in other sales categories.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 through 1962: Table 19.
 - 1963 and 1964: Table 18.
 - 1965 through 1967: Table 17.
 - 1968 through 1975: Table 14.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 14.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VOE_Mgal_a.htm.
- 1988 through 1994: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VOE_Mgal_a.htm.

- 1995 forward: Series discontinued; no data available. Values are assumed to be zero.

DFRRPZZ — Distillate fuel oil sales for use by railroads by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 and 1961: Table 16.
 - 1962 and 1963: Table 15.
 - 1964 and 1965: Table 14.
 - 1966 through 1975: Table 10.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 10.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VRR_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VRR_Mgal_a.htm.

DFRSPZZ — Distillate fuel oil sales to the residential sector for space heating, water heating, and cooking.

- 1960 through 1978: EIA estimates based on statistics of residential sector deliveries of distillate fuel oil from the EIA, *Energy Data Report*, "Deliveries of Fuel Oil and Kerosene in 1979," Table 1. State ratios based on 1979 residential sector deliveries were applied to each state's sum of heating plus industrial (including farm use) deliveries categories from the fuel oil deliveries reports for each year 1960 through 1978. (See explanation in Note 3, on page 37.)
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 4.

Note: Data for 1983 forward are published in thousand gallons. They are

converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A12.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VRS_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_VRS_Mgal_a.htm.

DFTCKUS — Factor for converting distillate fuel oil from physical units to Btu.

- 1960 through 1993: EIA adopted the Bureau of Mines thermal conversion factor of 5.825 million Btu per barrel, from the Bureau of Mines internal memorandum "Bureau of Mines Standard Average Heating Value of Various Fuels, Adopted January 3, 1950."
- 1994 forward: EIA calculates the national annual average thermal conversion factor, which includes biodiesel blended into distillate fuel oil, by using heat content values of three sulfur-content categories of distillate fuel oil, weighted by quantity consumed. See Appendix B Table B1 on page 167.

DFTCPUS — Distillate fuel oil total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Statement Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

DKEIPZZ — Distillate fuel oil consumed by the electric power sector, including kerosene-type jet fuel before 2001.

- EIA, Form EIA-923, "Power Plant Operations Report," and predecessor forms. The following assumptions have been made:
 - 1960 through 1969: Only total fuel oil consumed at electric utilities by state is available. State estimates of distillate fuel oil consumption were created for each year by applying the shares of internal

combustion and gas turbine plants (primarily distillate fuel oil plus small amounts of jet fuel) by state from 1970 to each year's total fuel oil consumption at electric utilities for 1960 through 1969.

- 1970 through 1979: Fuel oil consumed by plant type by state is available. Fuel oil consumed by internal combustion and gas turbine plants combined is assumed to equal distillate and jet fuel consumption.
- 1980 through 2000: Consumption of light fuel oil at all plant types by state is available. This is assumed to equal distillate and jet kerosene consumption.
- 2001 forward: Consumption of distillate fuel oil is available.

JKEUPZZ — Kerosene-type jet fuel consumed by the electric utility sector. (See data sources for JKEUPZZ under “Jet Fuel” on page 44.)

Jet Fuel

Jet fuel is used primarily for transportation, although small amounts of kerosene-type jet fuel are also used in the electric power sector. There are two types of jet fuel with different heat contents, kerosene-type jet fuel (JK) and naphtha-type jet fuel (JN), which are added in the State Energy Data System (SEDS) to give total jet fuel (JF). Beginning in 2005, naphtha-type jet fuel is included in “Miscellaneous Petroleum Products” in the data source, and is assigned a zero value in SEDS.

Kerosene-type jet fuel

Physical units

Data series used to calculate kerosene-type jet fuel consumption estimates are (“ZZ” in the variable name represents the two-letter state code that differs for each state):

JKTCPU\$	=	kerosene-type jet fuel total consumed, in thousand barrels;
JKEUPZZ	=	the electric utility sector consumption of kerosene-type jet fuel in each state, in thousand barrels (through 2000); and
JKTTPZZ	=	kerosene-type jet fuel total sold, in thousand gallons.

Total U.S. consumption of kerosene-type jet fuel, JKTCPU\$, is the product supplied data series in the publication *Petroleum Supply Annual*, published by the U.S. Energy Information Administration (EIA).

Kerosene-type jet fuel consumed by electric utilities, JKEUPZZ, is published by EIA in the *Cost and Quality of Fuels for Electric Utility Plants*. These data are available for 1972 through 1982 only. Consumption from 1983 forward is assumed to be zero in SEDS. Beginning in 2001, jet fuel used for power generation is included in waste/other oil in the source data file. Data for waste/other oil are not processed in SEDS because waste oil is not primary energy. Consumption of the petroleum products that produced the waste oil has been accounted for elsewhere.

Kerosene-type jet fuel total sold, JKTTPZZ, was collected by the Ethyl Corporation, Petroleum Chemicals Division, for 1960 through 1983, and is collected by the EIA for 1984 forward. The Ethyl Corporation data are sales to commercial users and are used to represent total sales based on the assumption that there is little military use of kerosene-type jet fuel during 1960 through 1983. (See Note 1 in the “Additional Notes” section for the

source reference for this assumption.) The EIA data for 1984 forward include commercial and military sales. Data for 1984 through 1993 are taken from the EIA *Petroleum Marketing Annual (PMA)*. Data for 1994 forward are taken from unpublished data in thousand gallons and are available in thousand gallons per day in the EIA *PMA* (through 2009) and on the EIA website. Prior to 1994, withheld data are estimated by using averages of published months to fill in withheld months; subtracting published states from published PAD district totals; and assigning values based on previous years' quantities. Beginning in 1994, withheld data are estimated using historical growth rates or state shares. They include Arizona (2009), Connecticut (2011), Delaware (1995, 1997, 1998, and 2013–2015), Hawaii (2002–2004 and 2008–2011), Iowa (2010), Nevada (2010 and 2011), New Hampshire (2009), Oregon (2002–2004 and 2008), Rhode Island (2011 and 2012), Tennessee (2010), and Vermont (2009 and 2012). Kerosene-type jet fuel sales in the District of Columbia are assumed to be zero (1994–2015).

U.S. totals for the two state data series are calculated as the sum of the state data.

Most kerosene-type jet fuel is used by the transportation sector. The transportation sector consumption for the United States (JKACPUS) is estimated as the difference between the total kerosene-type jet fuel consumed and the electric utility consumption:

$$\text{JKACPUS} = \text{JKTCPUS} - \text{JKEUPUS}$$

It is assumed that kerosene-type jet fuel consumption in each state is in proportion to the amount sold in each state:

$$\text{JKACPZZ} = (\text{JKTTPZZ} / \text{JKTTPUS}) * \text{JKACPUS}$$

Total kerosene-type jet fuel by state is estimated as:

$$\text{JKTCPZZ} = \text{JKACPZZ} + \text{JKEUPZZ}$$

British thermal units (Btu)

Kerosene-type jet fuel has a heat content value of approximately 5.670 million Btu per barrel. This factor is applied to convert kerosene-type jet fuel from physical units to Btu:

$$\begin{aligned} \text{JKACBZZ} &= \text{JKACPZZ} * 5.670 \\ \text{JKACBUS} &= \Sigma \text{JKACBZZ} \\ \text{JKEUBZZ} &= \text{JKEUPZZ} * 5.670 \\ \text{JKEUBUS} &= \Sigma \text{JKEUBZZ} \end{aligned}$$

$$\begin{aligned} \text{JKTCBZZ} &= \text{JKTCPZZ} * 5.670 \\ \text{JKTCBUS} &= \Sigma \text{JKTCBZZ} \end{aligned}$$

Additional notes

1. An assumption is made that kerosene-type jet fuel use by the military in 1960 through 1983 is negligible. This assumption is based on product definitions from the American Petroleum Institute's *Standard Definitions for Petroleum Statistics*, Technical Report No. 1, Third Edition (1981), page 13, which states that kerosene-type jet fuel is used primarily by commercial aircraft engines.
2. Ethyl Corporation jet fuel sales to commercial users by state include some sales data that were improperly allocated between the states of Illinois and Indiana for 1960 through 1973. To adjust for this error, the average relative proportions of Illinois and Indiana sales from 1974 through 1978 were applied to the sum of the Illinois and Indiana sales in 1960 through 1973. From 1974 through 1983, sales data were correctly allocated.
3. Jet fuel sales in Illinois decreased sharply from 1984 forward, while sales in Indiana increased by about the same amount. It is possible that jet fuel for use at Chicago, Illinois, airports may have been purchased in Indiana. The same anomaly may have happened between New York and New Jersey beginning in 1981, when jet fuel for consumption at New York City airports may have been purchased in New Jersey. This is an inherent problem when using sales data as an indication of consumption, and no attempt has been made to adjust the numbers.
4. Prior to 1964, kerosene-type jet fuel was included in the total kerosene product supplied data in the source, the U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Statement, Annual," Table 2, "Salient Statistics of the Major Refined Petroleum Products in the United States." Table TN4.2 summarizes the derivation of kerosene and jet fuel consumption estimates (columns 4 and 5) from data published in the source (columns 1, 2, and 3) for 1960 through 1963. For 1964 and years following, kerosene and kerosene-type jet fuel are reported separately in the source documents.
5. Kerosene-type jet fuel consumed by electric utilities, JKEUPZZ, is published in the EIA *Cost and Quality of Fuels for Electric Utility Plants*. These data are available for 1972 through 1982 only. Consumption in all other years is assumed to be zero. State-level data for 1972 through 1974 are not available. The percentage of each state's consumption of the total U.S. consumption in 1975 was used to apportion the 1972

through 1974 national data to the states.

Data sources

JKEUPZZ — Kerosene-type jet fuel consumed by electric utilities by state.

- 1960 through 1971: No data available. Values are assumed to be zero.
- 1972 through 1974: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Sales of Fuel Oil and Kerosene,” Table 15 footnote for U.S. value. These data were apportioned to the states by using the 1975 state proportions of the 1975 U.S. total from the source below.
- 1975 through 1979: Office of Electric Power Regulation, Federal Energy Regulatory Commission, *Annual Summary of Cost and Quality of Electric Utility Plant Fuels*, “Fuel Oil Deliveries for Combustion Turbine and Internal Combustion Units.”
- 1980 through 1982: EIA, *Cost and Quality of Fuel for Electric Utility Plants*, Table 30.
- 1983 forward: Data not available. Values are assumed to be zero in SEDS.

JKTPZZ — Kerosene-type jet fuel total sold by state.

- 1960 through 1983: Ethyl Corporation, Petroleum Chemicals Division, *Yearly Report of Gasoline Sales by States*, “Aviation Turbine Fuel Sales.”
- 1984 and 1985: EIA, *Petroleum Marketing Annual 1985*, Volume 2.
 - 1984: Table A6.
 - 1985: Table 34.
- 1986 through 1988: EIA, *Petroleum Marketing Annual*, Table 46.
- 1989 through 1993: EIA, *Petroleum Marketing Annual*, Table 48.
- 1994 forward: Unpublished data in thousand gallons from Form EIA-782C, “Monthly Report of Prime Supplier Sales of Petroleum Products Sold for Local Consumption.” Data published in thousand gallons per day in EIA, *Petroleum Marketing Annual*, http://www.eia.gov/oil_gas/petroleum/data_publications/petroleum_marketing_annual/pma_historical.html and on the Prime Supplier Sales Volumes website at http://www.eia.gov/dnav/pet/pet_cons_prim_a_EPJK_P00_Mgalpd_a.htm.
 - 1994 through 2006: Table 49.
 - 2007 through 2009: Table 46.
 - 2010 forward: Web table only, at http://www.eia.gov/dnav/pet/pet_cons_prim_a_EPJK_P00_Mgalpd_a.htm.

JKTCPU — Kerosene-type jet fuel total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Petroleum Statement, Annual,” Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, “Petroleum Statement, Annual,” Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled “Products Supplied.” The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Naphtha-type jet fuel

Physical units

Two data series are used to estimate naphtha-type jet fuel consumption:

- | | | |
|---------|---|--|
| JNTCPUS | = | naphtha-type jet fuel total consumed, in thousand barrels; and |
| JNMIPZZ | = | naphtha-type jet fuel issued to the military in each state, in thousand barrels. |

Total U.S. consumption of naphtha-type jet fuel, JNTCPUS, is the product supplied data series in the publication *Petroleum Supply Annual*, published by the EIA. Beginning in 2005, it is included in “Miscellaneous Petroleum Products,” and is assigned a zero value in SEDS.

It is assumed that all naphtha-type jet fuel is used in military aircraft engines. (See the Additional Notes at the end of this section for the source reference for this assumption.) Data on naphtha-type jet fuel issued to the military in each state, JNMIPZZ, are from the U.S. Department of Defense, Defense Logistics Agency, Defense Fuel Supply Center.

The total U.S. military issues is the sum of the state data:

$$JNMIPUS = \sum JNMIPZZ$$

An estimate of naphtha-type jet fuel consumption by state, JNTCPZZ, is calculated by assuming that each state consumes naphtha-type jet fuel in proportion to the amount issued to the military in that state:

$$JNTCPZZ = (JNMIPZZ / JNMIPUS) * JNTCPUS$$

All naphtha-type jet fuel is assumed to be used for transportation purposes so the transportation consumption equals the estimated total consumption for each state and for the United States:

$$\begin{aligned}\text{JNACPZZ} &= \text{JNTCPZZ} \\ \text{JNACPUS} &= \text{JNTCPUS}\end{aligned}$$

British thermal units (Btu)

Naphtha-type jet fuel has a heat content value of approximately 5.355 million Btu per barrel. This factor is applied to convert naphtha-type jet fuel from physical units to Btu:

$$\begin{aligned}\text{JNTCBZZ} &= \text{JNTCPZZ} * 5.355 \\ \text{JNTCBUS} &= \Sigma \text{JNTCBZZ}\end{aligned}$$

Naphtha-type jet fuel consumed in the transportation sector is equal to total consumption.

$$\begin{aligned}\text{JNACBZZ} &= \text{JNTCBZZ} \\ \text{JNACBUS} &= \text{JNTCBUS}\end{aligned}$$

Additional notes

1. An assumption is made that the naphtha-type jet fuel is for military use only. This assumption is based on product definitions from the American Petroleum Institute's *Standard Definitions for Petroleum Statistics*, Technical Report No. 1, Third Edition (1981), page 13, which states that naphtha-type jet fuel is used primarily by military aircraft engines.
2. Data on naphtha-type jet fuel issued to the military for each state (JNMIPZZ) are obtained from the U.S. Department of Defense, Defense Logistics Agency, Defense Fuel Supply Center. There are no data available for 1960 through 1974, and the data available for 1975 and 1976 are not consistent; therefore, the 1977 values are used for 1960 through 1976 in SEDS. The data are reported by fiscal year for 1977 through 1988 and are taken from the Defense Energy Information System. For 1989 and 1990, fiscal-year data from two databases, Defense Fuel Automated Management System and the Into-Plane Database, are summed. For 1991 and 1992, data from the same two databases, reported by calendar year, are used.
3. Since total naphtha-type jet fuel product supplied is assumed to be zero beginning in 2005, naphtha-type jet fuel issued to the military is also assumed to be zero for 2005 forward.

Data sources

JNMIPZZ — Naphtha-type jet fuel issued to the military in the United States.

- 1960 through 1974: No data are available. The 1977 data are used for each year.
- 1975 and 1976: No consistent data series are available. The 1977 data are used for both years.
- 1977 through 1987: The U.S. Department of Defense, Defense Logistics Agency, Defense Fuel Supply Center, Defense Energy Information System, military retail issues based on fiscal year data. The District of Columbia issues are assumed to be zero; therefore, values reported for the District of Columbia are added to Maryland.
- 1988: U.S. Department of Defense, Defense Logistics Agency, Defense Fuel Supply Center, average of 1987 data (see source above) and 1989 data (see source below).
- 1989 and 1990: U.S. Department of Defense, Defense Logistics Agency, Defense Fuel Supply Center, Defense Fuel Automated Management System, military wholesale issues based on fiscal year data.
- 1991 through 2004: U.S. Department of Defense, Defense Logistics Agency, Defense Energy Supply Center. State data for the calendar year from two databases are summed: Defense Fuel Automated Management System (military wholesale issues) and Into-Plane Database (military purchases from commercial airports). Into-plane values reported for the District of Columbia are added to Virginia.
- 2005 forward: Value entered in SEDS as zero.

JNTCPUS — Naphtha-type jet fuel total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Data not reported separately. Volumes are included in "Miscellaneous Products" in the *Petroleum Supply Annual*, Table 1. Value entered in SEDS as zero.

Table TN4.2. Estimate of U.S. consumption of kerosene and jet fuel for 1960 through 1963 (Thousand barrels)

Year	(1) Kerosene demand, including commercial jet fuel	(2) Jet fuel demand, military use only	(3) Sales of kerosene for commercial jet fuel use	(4) Estimated kerosene consumption (1) – (3)	(5) Estimated total jet fuel consumption (2) + (3)
1960	132,499	102,803	33,159	99,340	135,962
1961	144,435	104,436	47,187	97,248	151,623
1962	164,167	112,401	66,134	98,033	178,535
1963	172,212	115,237	75,236	96,976	190,473

Jet fuel totals

Physical units

The following calculations are used to provide total jet fuel consumption estimates by end use in physical units:

$$\begin{aligned}\text{JFACPZZ} &= \text{JKACPZZ} + \text{JNACPZZ} \\ \text{JFACPUS} &= \Sigma \text{JFACPZZ} \\ \text{JFEUPZZ} &= \text{JKEUPZZ} \\ \text{JFEUPUS} &= \text{JKEUPUS} \\ \text{JFTCPZZ} &= \text{JFACPZZ} + \text{JFEUPZZ} \\ \text{JFTCPUS} &= \Sigma \text{JFTCPZZ}\end{aligned}$$

British thermal units (Btu)

The following calculations are used to provide total jet fuel consumption estimates by end use in Btu:

$$\begin{aligned}\text{JFACBZZ} &= \text{JKACBZZ} + \text{JNACBZZ} \\ \text{JFACBUS} &= \Sigma \text{JFACBZZ} \\ \text{JFEUBZZ} &= \text{JKEUBZZ} \\ \text{JFEUBUS} &= \text{JKEUBUS} \\ \text{JFTCBZZ} &= \text{JFACBZZ} + \text{JFEUBZZ} \\ \text{JFTCBUS} &= \Sigma \text{JFTCBZZ}\end{aligned}$$

Physical units

Because state-level and end-use consumption data for kerosene are not available, four data series published by the U.S. Energy Information Administration (EIA) representing sales of kerosene into or within each state are used to estimate kerosene consumption. The fifth data series, the U.S. total consumption, is the product supplied series from the EIA *Petroleum Supply Annual*. The sales series are used to apportion the known U.S. total consumption into state-level estimates of end-use consumption. The following variable names have been assigned to the five data series ("ZZ" in the variable names represents the two-letter state code that differs for each state):

KSCMPZZ	=	kerosene sold to the commercial sector for heating, in thousand barrels;
KSIHPZZ	=	kerosene sold to the industrial sector for heating, in thousand barrels;
KSOTPZZ	=	kerosene sold for all other uses, including farm use, in thousand barrels;
KSRSPZZ	=	kerosene sold to the residential sector for heating, in thousand barrels; and
KSTCPUS	=	kerosene total consumed in the United States, in thousand barrels.

U.S. sales totals for each of the four state-level series are created by summing the state values.

The variables are combined as closely as possible into the major end-use sectors used in SEDS. The residential and commercial sectors contain only KSRSPZZ and KSCMPZZ, respectively.

The sales of kerosene to the industrial sector, KSINPZZ, for each state is the sum of kerosene sold for industrial space heating (KSIHPZZ) and kerosene sold for all other uses (KSOTPZZ), including farm use. Sales of kerosene to the industrial sector are calculated:

KSINPZZ	=	KSOTPZZ + KSIHPZZ
KSINPUS	=	ΣKSINPZZ

Total sales of kerosene in each state is the sum of these three sectors' sales:

KSTTPZZ	=	KSRSPZZ + KSCMPZZ + KSINPZZ
KSTTPUS	=	ΣKSTTPZZ

An estimate of each state's total consumption of kerosene is made by disaggregating the U.S. total consumption to the states in proportion to each state's sales share of the U.S. total sales:

$$KSTCPZZ = (KSTTPZZ / KSTTPUS) * KSTCPUS$$

Each state's residential sector sales percentage of total sales is applied to the state's estimated total consumption to create estimated residential sector consumption for the state, KSRCPZZ:

$$KSRCPZZ = (KSRSPZZ / KSTTPZZ) * KSTCPZZ$$

The commercial sector's estimated consumption in each state, KSCCPZZ, is calculated:

$$KSCCPZZ = (KSCMPZZ / KSTTPZZ) * KSTCPZZ$$

The industrial sector's estimated consumption in each state, KSICPZZ, is calculated:

$$KSICPZZ = (KSINPZZ / KSTTPZZ) * KSTCPZZ$$

U.S. totals for the three sectors' consumption estimates are the sums of the states' estimated consumption.

Data on kerosene consumed by the electric power sector are not available before 2003. Beginning in 2003, kerosene used for power generation is included in waste/other oil in the source data file. Data for waste/other oil are not processed in SEDS because waste oil is not primary energy. Consumption of the petroleum products that produced the waste oil has been accounted for elsewhere.

British thermal units (Btu)

Kerosene has a heat content value of approximately 5.670 million Btu per barrel. This factor is applied to convert kerosene estimated consumption from physical units to Btu:

KSRCBZZ	=	KSRCPZZ * 5.670
KSCCBZZ	=	KSCCPZZ * 5.670
KSICBZZ	=	KSICPZZ * 5.670

Total estimated consumption of kerosene in Btu is the sum of the end-use consumption estimates:

$$KSTCBZZ = KSRCBZZ + KSCCBZZ + KSICBZZ$$

The U.S. Btu consumption estimates for the three consuming sectors and the U.S. total are calculated as the sum of the state-level data.

Additional notes

1. See Note 4 at the end of the “Kerosene-type jet fuel” section on page 43 for comments concerning the inclusion of kerosene-type jet fuel with the kerosene total product supplied prior to 1964 in the source documents.
2. “Sales” data are actually called “shipments” in the source documents for 1960 and 1961; “consumption” for 1962 through 1966; “shipments” for 1967; “sales” from 1968 through 1978; “deliveries” for 1979 through 1983; and “sales” for 1984 forward.
3. In 1979, the EIA implemented a new survey form, EIA-172, to obtain deliveries of fuel oil and kerosene data and updated the list of respondents. (A detailed explanation is published in the *Energy Data Report* “Deliveries of Fuel Oil and Kerosene in 1979.”) In this survey form, certain end-use categories were redefined—in many cases, to collect more disaggregated data. The reclassifications resulted in some end-use categories that were no longer comparable with those in previous surveys. Where discontinuities occurred, estimates for the pre-1979 years have been made in SEDS to conform with the 1979 kerosene deliveries classifications. The pre-1979 deliveries estimates are not published in this report but are used in SEDS to disaggregate the known U.S. total product supplied (consumption) into state and major end-use sector consumption estimates.

For kerosene deliveries in 1979, the end-use categories called “residential,” “commercial,” and “industrial” are available. The pre-1979 deliveries category called “heating” is related to the sum of “residential,” “commercial,” and “industrial” in 1979. Therefore, the following method was applied to present a comparable series for kerosene delivered to the residential, commercial, and industrial sectors:

- A 1979 subtotal for heating was created by summing each state’s residential, commercial, and industrial deliveries categories, thereby creating a comparable deliveries subtotal for all years.
- Residential, commercial, and industrial shares of the heating subtotal in 1979 were calculated for each state.
- These 1979 end-use shares were then applied to each pre-1979 heating subtotal in each state to create state estimates of end-use deliveries for 1960 through 1978.

The 1980 through 1982 kerosene deliveries data are based on the same survey as that used for 1979; therefore, the 1980 through 1982 data are

directly comparable to 1979 data.

4. In 1984, EIA again updated the list of respondents for this survey, and the Form EIA-172 became the Form EIA-821, “Annual Fuel Oil and Kerosene Sales Report.” EIA did not conduct a fuel oil and kerosene sales survey for 1983. The 1983 estimates in SEDS are based on 1984 data obtained from the Form EIA-821. Statistical procedures and methodologies used for the Form EIA-821 differ from those used in previous years and are described in the July 1985 issue of the EIA, *Petroleum Marketing Monthly*. Therefore, the 1983 and forward sales data may not be directly comparable to the pre-1983 data. (In the source document, the sales data for 1983 forward are reported in thousand gallons. These data were first converted to thousand barrels before being entered into SEDS.)
5. In 1975 through 1977, the industrial sector consumption of kerosene includes small quantities of kerosene-type jet fuel that were produced as jet fuel and sold as kerosene.

Data sources

KSCMPZZ — Kerosene sold to the commercial sector for heating.

- 1960 through 1978: EIA estimates based on statistics of commercial sector deliveries of kerosene from the EIA, *Energy Data Report*, “Deliveries of Fuel Oil and Kerosene, in 1979,” Table 3. State ratios based on 1979 commercial sector deliveries were applied to each state’s heating deliveries category from the fuel oil deliveries reports for each year 1960 through 1978. (See explanation in Note 3.)
- 1979 and 1980: EIA, *Energy Data Report*, “Deliveries of Fuel Oil and Kerosene,” Table 3.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 6.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983 through 1987: EIA, *Petroleum Marketing Monthly*. The specific tables are:
 - 1983: July 1985 issue, Table A14.
 - 1984: July 1986 issue, Table A4, subsequently revised in the EIA, *Petroleum Navigator*, http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_VCS_Mgal_a.htm.
 - 1985 and 1986: July 1987 issue, Table A6.
 - 1987: June 1988 issue, Table A6.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_VCS_Mgal_a.htm, select Excel

file labeled "Download Series History."

KSIHPZZ — Kerosene sold to the industrial sector for heating.

- 1960 through 1978: EIA estimates based on statistics of industrial sector deliveries of kerosene from the EIA, *Energy Data Report*, "Deliveries of Fuel Oil and Kerosene in 1979," Table 3. State ratios based on 1979 industrial sector deliveries were applied to each state's heating deliveries category from the fuel oil deliveries reports for each year 1960 through 1978. (See explanation in Note 3, on page 48.)
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 3.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 6.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983 through 1987: EIA, *Petroleum Marketing Monthly*. The specific tables are:
 - 1983: July 1985 issue, Table A14.
 - 1984: July 1986 issue, Table A4, subsequently revised in the EIA, Petroleum Navigator, http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_vin_Mgal_a.htm.
 - 1985 and 1986: July 1987 issue, Table A6.
 - 1987: June 1988 issue, Table A6.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_vin_Mgal_a.htm, select Excel file labeled "Download Series History."

KSOTPZZ — Kerosene sold for all other uses, including farm use.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 and 1961: Table 10.
 - 1962 and 1963: Table 9.
 - 1964 and 1965: Table 8.
 - 1966 through 1975: Table 5.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 5.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene." Calculated as the sum of kerosene delivered for farm and

other use from Table 3.

- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 6.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983 through 1987: EIA, *Petroleum Marketing Monthly*. The specific tables are:
 - 1983: July 1985 issue, Table A14.
 - 1984: July 1986 issue, Table A4, subsequently revised in the EIA, Petroleum Navigator, http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_VOE_Mgal_a.htm and http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_VFM_Mgal_a.htm.
 - 1985 and 1986: July 1987 issue, Table A6.
 - 1987: June 1988 issue, Table A6.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_VOE_Mgal_a.htm and http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_VFM_Mgal_a.htm, select Excel file labeled "Download Series History."

KSRSPZZ — Kerosene sold to the residential sector for heating.

- 1960 through 1978: EIA, *Energy Data Report*, "Deliveries of Fuel Oil and Kerosene in 1979," Table 3. State ratios based on 1979 residential sector deliveries were applied to each state's heating deliveries category from the fuel oil deliveries reports for each year 1960 through 1978. (See explanation in Note 3, on page 48.)
- 1979 and 1980: EIA, *Energy Data Report*, "Deliveries of Fuel Oil and Kerosene," Table 3.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 6.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983 through 1987: EIA, *Petroleum Marketing Monthly*. The specific tables are:
 - 1983: July 1985 issue, Table A14.
 - 1984: July 1986 issue, Table A4, subsequently revised in the EIA, Petroleum Navigator, http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_VRS_Mgal_a.htm.
 - 1985 and 1986: July 1987 issue, Table A6.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, http://www.eia.gov/dnav/pet/pet_cons_821ker_a_EPPK_VRS_Mgal_a.htm, select Excel

file labeled "Download Series History."

KSTCPUS — Kerosene total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*. "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Liquefied Petroleum Gases

Liquefied petroleum gases (LPG) in the State Energy Data System (SEDS) include: ethane/ethylene, propane/propylene, normal butane/butylene, butane-propane mixtures, ethane-propane mixtures, and isobutane/isobutylene.

Physical units

For 1960 through 2007, the following data series on LPG sales in thousand gallons are used in SEDS to estimate LPG consumption by state.

LGCBMZZ	=	LPG sold for internal combustion engine fuel use. Included are sales for use in highway vehicles, forklifts, industrial tractors, and for use in oil field drilling, and production equipment, etc.;
LGHCMZZ	=	LPG sold for residential and commercial use. Included are sales for nonfarm private households for space heating, cooking, water heating, and other household uses, such as clothes drying and incineration. Also included are sales to nonmanufacturing organizations, such as motels, restaurants, retail stores, laundries, and other service enterprises, primarily for use in space heating, water heating, and cooking; and
LGTPZZ	=	LPG total sales for all uses.

Data before 1984 were available from the Bureau of Mines reports, U.S. Energy Information Administration (EIA) reports, or were estimated by EIA. From 1984 through 2007, data were extracted from American Petroleum Institute's (API) *Sales of Natural Gas Liquids and Liquefied Refinery Gases*. Withheld state-level sales data are first estimated by EIA by using previous year's data and ensuring all subtotals match the source document.

The U.S. totals for each of these state-level data series are calculated as the sum of the state values.

Total U.S. consumption of LPG is the product supplied data series in EIA *Petroleum Supply Annual*:

LGTCBUS	=	LPG total consumed in the United States, in thousand barrels.
---------	---	---

Another variable is used in SEDS to estimate LPG consumption by the transportation sector:

LGTRSUS = the transportation sector share of LPG internal combustion engine sales.

Its computation is described in detail in Note 2 on page 52.

Similarly, variables are used in SEDS to estimate LPG consumption by the residential and commercial sectors:

LGRCZZ = the residential sector share of LPG residential and commercial sales; and

LGCCZZ = the commercial sector share of LPG residential and commercial sales.

Their computation is described in detail in Note 3 on page 53.

Since the LPG sales data are in gallons, they must be converted to barrels (42 U.S. gallons per U.S. barrel) to be comparable to total consumption estimates. The formulas for calculating state sales data are:

LGCBPZZ = LGCBMZZ / 42

LGCBPUS = Σ LGCBPZZ

LGHCPZZ = LGHCMZZ / 42

LGHCPUS = Σ LGHCPZZ

It is also assumed that LPG sales to the residential and commercial sectors are equal to the consumption in those sectors. LPG consumption by the residential sector is estimated to be the residential share of propane sales for the residential and commercial sectors:

LGRCPPZZ = LGHCPZZ * LGRCZZ

LPG consumption by the commercial sector is estimated to be the commercial share of propane sales for the residential and commercial sectors:

LGCCPPZZ = LGHCPZZ * LGCCZZ

LPG consumption by the transportation sector is estimated to be the transportation share of the sales for internal combustion engine fuel:

LGACPZZ = LGCBPZZ * LGTRSUS

An estimate of each state's total LPG consumption (LGTCPZZ) is made by allocating the U.S. total consumption to the states in proportion to each state's share of the U.S. total sales:

LGTCPZZ = (LGTTPZZ / LGTTPUS) * LGTTPUS

Industrial sector consumption (LGICPZZ) for each state is the difference between the state's total LPG consumption and the sum of its residential, commercial, and transportation sectors' consumption:

LGICPZZ = LGTCPZZ - (LGRCPPZZ + LGCCPPZZ + LGACPZZ)

U.S. totals for the four end-use sector consumption estimates are calculated as the sums of the state estimates.

Beginning in 2008, the API report only covers sales of propane (including propylene). A new methodology is developed to estimate state-level propane consumption and all other LPG consumption. For propane consumption, API's state shares of propane sales are applied to the U.S. propane product supplied published in EIA's Petroleum Supply Annual (PSA).

In SEDS, it is assumed that LPG consumed by the residential, commercial, and transportation sectors and for internal combustion fuel is solely propane. The propane consumption for the residential and commercial sectors and for internal combustion engine fuel use are assigned to LGHCMZZ and LGCBMZZ respectively. The same methodology used for 1960 through 2007 to derive LPG consumption for the residential, commercial, and transportation sectors is maintained:

LGCBPZZ = LGCBMZZ / 42

LGHCPZZ = LGHCMZZ / 42

LGRCPPZZ = LGHCPZZ * LGRCZZ

LGCCPPZZ = LGHCPZZ * LGCCZZ

LGACPZZ = LGCBPZZ * LGTRSUS

LPG consumption for the industrial sector, LGICP, is estimated by summing the estimates for the four components:

- Propane — State-level industrial consumption is calculated by subtracting residential, commercial, and transportation sector consumption from total propane consumption.
- Ethane — Data on ethane feed slate capacity of ethylene steam crackers published by the *Oil and Gas Journal* (OGJ) are used to compute a set of state-level preliminary ethane demand, using an ethylene yield factor of 0.8 and a conversion factor of 16.85 barrels per metric ton. Ethane estimates for the two largest consuming states, Louisiana and Texas (where most, if not all, flexible crackers are located), are further adjusted so that the sum of all states' ethane consumption matches the U.S. ethane product supplied published in PSA.
- Normal butane (n-butane) consumed by steam crackers is estimated using data on n-butane feed slate capacity from OGJ and applied them

to the U.S. ethylene feed slate demand for n-butane, also available from OGJ. N-butane for other uses, defined as U.S. n-butane total product supplied less ethylene feed slate demand, is allocated to Texas.

- Isobutane — The U.S. product supplied of isobutane is allocated to Texas.

N-butane and isobutane used in gasoline blending and alkylation at the refineries are accounted for in intermediate product processing and not considered end-use consumption.

U.S. totals for the four end-use sector consumption estimates are calculated as the sums of the state estimates.

Total LPG consumption, LGTCP, is the sum of the four end-use sectors' LPG consumption:

$$\text{LGTCPZZ} = \text{LGRCPZZ} + \text{LGCCPZZ} + \text{LGICPZZ} + \text{LGACPZZ}$$

British thermal units (Btu)

The Btu consumption of LPG for the United States, LGTCBUS, is extracted from EIA's *Annual Energy Review* and *Monthly Energy Review*. It is calculated by multiplying total physical unit consumption (LGTCPUS) with an average conversion factor for LPG. The factor for converting LPG from physical unit values to Btu, LGTCKUS, is calculated annually for 1967 forward by EIA as a consumption-weighted average of the heat contents of the component products (ethane, propane, normal butane, and isobutane) as shown in Appendix B. LGTCKUS is shown in Table B1 on page 167 and the individual product heat contents are listed beginning on page 167. For 1960 through 1966, EIA adopted the Bureau of Mines thermal conversion factor of 4.011 million Btu per barrel.

$$\begin{aligned} \text{LGTCBUS} &= \text{LPG total consumed in the United States, in billion Btu; and} \\ \text{LGTCKUS} &= \text{Factor for converting U.S. consumption of LPG from physical units to Btu.} \end{aligned}$$

Since the residential, commercial, and transportation sectors consume mainly propane, it is more appropriate to use the heat content of propane (3.836 million Btu per barrel) to convert LPG consumption for these three sectors into Btu:

$$\begin{aligned} \text{LGRCBZZ} &= \text{LGRCPZZ} * 3.836 \\ \text{LGCCBZZ} &= \text{LGCCPZZ} * 3.836 \end{aligned}$$

$$\text{LGACBZZ} = \text{LGACPZZ} * 3.836$$

The U.S. totals for the three sectors are the sum of the state estimates.

Industrial sector consumption for the United States is calculated by subtracting the three sectors' consumption estimates from the total:

$$\text{LGICBUS} = \text{LGTCBUS} - (\text{LGRCBUS} + \text{LGCCBUS} + \text{LGACBUS})$$

Industrial sector consumption for each state is estimated by allocating the U.S. industrial consumption to the states in proportion to the physical unit share:

$$\text{LGICBZZ} = (\text{LGICPZZ} / \text{LGICPUS}) * \text{LGICBUS}$$

Total estimated consumption of LPG is the sum of the end-use consumption estimates:

$$\text{LGTCBZZ} = \text{LGRCBZZ} + \text{LGCCBZZ} + \text{LGICBZZ} + \text{LGACBZZ}$$

The average conversion factor for industrial consumption of LPG, LGICKUS, is calculated for use in the price computation:

$$\text{LGICKUS} = \text{LGICBUS} / \text{LGICPUS}$$

Additional notes

1. Sales data for Maryland and the District of Columbia (D.C.) are combined in the source documents through 2009. Sales data are published in six categories through 2007. The percentages shown in Table TN4.3 are applied to disaggregate the state data in each of the sectors for these years. For 2008 and 2009, the same percentages for the residential and commercial, and internal combustion engine fuel shown in Table TN4.3 are applied to the combined Maryland and D.C. sales for those sales categories. The percentages for the remaining categories are combined using the 2007 data for those categories, resulting in 99.79% for Maryland and 0.21% for D.C. These percentages are applied to the remaining volumes of the combined Maryland and D.C. sales. For 2010 forward, data for Maryland and D.C. are presented separately in the source document.
2. Sales of LPG for internal combustion engine fuel use are divided between the transportation sector and the industrial sector by using LGTRSUS, the transportation sector's share of internal combustion engine use. LGTRSUS is estimated from data on "special fuels used on highways," a category that includes only LPG and diesel fuel. The special fuels

data are published by the U.S. Department of Transportation, Federal Highway Administration (see MGSFPZZ on page 61). The quantity of LPG included in special fuels is estimated each year. LGTRSUS is then derived by dividing the quantity of LPG included in special fuels used on highways by the quantity of LPG sold for internal combustion engine use. This U.S. factor is applied to the internal combustion engine use of each state. LGTRSUS values are shown in Table TN4.4.

3. The shares of propane used by the residential (LGRCS) and commercial (LGCCS) sectors for each state are based on propane sales data in the API report for 2003 forward. The average shares of 2003 through 2008 are applied to the earlier years. Data for LPG sold for residential and commercial use are then split into the two end-use sectors using these two variables.
4. LPG sales data by state and end-use categories for 1960 through 1982 are from EIA's "Sales of Liquefied Petroleum Gases and Ethane." In 1979, EIA modified the LPG sales survey, Form EIA-174, and changed the list of respondents. Because of the updated sampling frame, the 1979 through 1982 sales data may not be directly comparable to the pre-1979 sales when a different estimation procedure was used. Explanation of the discontinuities caused by the change in the 1979 sampling frame are provided in EIA's *Energy Data Report*, "Sales of Liquefied Petroleum Gases and Ethane in 1979." Because of the change in survey techniques used for measuring LPG sales, many states' data were withheld from publication in the 1979 through 1982 LPG sales reports to avoid disclosure of company-level data. The consumption estimates in SEDS use all data published in the 1979 through 1982 LPG sales reports and estimates prepared by EIA's Office of Oil and Gas for data that were withheld from publication. (See Note 5 following for estimation procedures.) Some end-use categories changed in 1979 due to redefinition of the classifications. One of these changes, for example, occurred with LPG sold to farms for household heating and cooking. Prior to 1979 these sales were reported as part of the residential and commercial category, while in 1979 they were counted in the farm use category that goes into the industrial sector in SEDS. No attempt has been made to adjust for this type of inconsistency. The Form EIA-174 was cancelled after collection of 1982 data. The 1983 LPG consumption estimates are based on the assumption that LPG end-use sector demand in 1983 occurred in the same proportion as 1982 sector demand within each state; i.e., the 1983 LPG product supplied figure was allocated to the states by using the distribution of volumes consumed for 1982.
5. The following procedures were used to estimate the state end-use sales that were withheld from publication in the 1979-1982 LPG sales reports:
 - For each year, missing state total sales were estimated by allocating the sum of the missing state sales within each Petroleum Administration for Defense (PAD) district to the individual states, in proportion to the sum of the known end-use sales for those states.
 - Missing PAD district end-use totals for 1979 and 1980 were obtained by using the 1980 and 1981 sales reports. Missing PAD district chemical sales were estimated by allocating the total missing volume of chemical sales to the PAD district in proportion to the number of chemical plants in each PAD district. The remaining PAD district end-use totals were obtained by subtraction. For 1981 and 1982, no PAD district estimations were necessary because all PAD district end-use totals are known.
 - The published data and the estimated state and PAD district end-use totals were used to estimate missing state end-use sales volumes within a PAD district: missing state end-use sector values were estimated by allocating the missing volume for the state approximately proportional to the PAD district end-use sector totals.
6. Prior to 1979, state data for chemical use of LPG were withheld from publication, although they were included in the U.S. total in the tables in EIA's "Sales of Liquefied Petroleum Gases and Ethane" reports. Beginning in 1979, state-level chemical use data were published in the LPG sales reports, but data for several states were withheld. Estimates for the withheld data for chemical use sales for 1979 and 1980 were created by using the estimation procedure described in Note 5 above. Then the published and the estimated state data for 1979 were used to create state shares of the total U.S. chemical use sales. These percentage shares (shown in Table TN4.5) were applied to the total U.S. LPG chemical use sales in 1960 through 1978 to create state chemical use estimates. The chemical use estimates were added to the states' total LPG sales series, LGTTPZZ.
7. For 1984 through 2007, the American Petroleum Institute (API), the Gas Processors Association, and the National LP-Gas Association jointly sponsored an LPG sales survey. The results are published in the API's report *Sales of Natural Gas Liquids and Liquefied Refinery Gases*. These data include sales of pentanes plus; the pentanes plus data were removed by EIA prior to use in SEDS.

For 1997 through 2007, API incorporated additional imports and

exports data in their estimates. Those trade data are also removed by EIA prior to use in SEDS.

Data sources

LGCBMZZ — LPG sold for internal combustion engine use by state. Note: Data for Maryland and the District of Columbia are combined for all years. The method for disaggregating the data is explained in Note 1, on page 52.

- 1960 through 1967: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Liquefied Petroleum Gases and Ethane." The specific tables are:
 - 1960 and 1961: Table 5 (data called "Shipments").
 - 1962 through 1966: Table 2 (data called "Consumption").
 - 1967: Table 2 (data called "Shipments").
- 1968 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Sales of Liquefied Petroleum Gases and Ethane," Table 2.
- 1976 through 1980: EIA, *Energy Data Reports*, "Sales of Liquefied Petroleum Gases and Ethane," Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, "Sales of Liquefied Petroleum Gases and Ethane," Table 3.
- 1983: EIA estimates.

Note: For 1984 forward, some data are adjusted and estimated by EIA. (See explanation in Note 7 above.)

- 1984 through 1988: American Petroleum Institute, *1990 Sales of Natural Gas Liquids and Liquefied Refinery Gases*, pages 24 through 33.
- 1989 through 1991: American Petroleum Institute, *1992 Sales of Natural Gas Liquids and Liquefied Refinery Gases*, pages 4, 5, 18, and 19.
- 1992 through 2007: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table 3.
- 2008 forward: EIA estimates based on propane sold for internal combustion engine use by state, published by the American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table B.

LGCCSZZ — Commercial sector share of residential and commercial sales of LPG.

- 1960 through 2002: EIA estimates based on the residential and commercial shares of propane used by the residential and commercial sectors published by the American Petroleum Institute.

- 2003 through 2007: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table 3.
- 2008 forward: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table B.

LGHCMZZ — LPG sold for residential and commercial use by state. Note: Data for Maryland and the District of Columbia are combined for all years. The method for disaggregating the data is explained in Note 1, on page 52.

- 1960 through 1967: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Liquefied Petroleum Gases and Ethane." The specific tables are:
 - 1960 and 1961: Table 5 (data called "Shipments").
 - 1962 through 1966: Table 2 (data called "Consumption").
 - 1967: Table 2 (data called "Shipments").
- 1968 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Sales of Liquefied Petroleum Gases and Ethane," Table 2.
- 1976 through 1980: EIA, *Energy Data Reports*, "Sales of Liquefied Petroleum Gases and Ethane," Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, "Sales of Liquefied Petroleum Gases and Ethane," Table 3.
- 1983: EIA estimates.

Note: For 1984 forward, some data are adjusted and estimated by EIA. (See explanation in Note 7, on page 53).

- 1984 through 1988: American Petroleum Institute, *1990 Sales of Natural Gas Liquids and Liquefied Refinery Gases*, pages 24 through 33.
- 1989 through 1991: American Petroleum Institute, *1992 Sales of Natural Gas Liquids and Liquefied Refinery Gases*, pages 4, 5, 18, and 19.
- 1992 through 2007: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table 3.
- 2008 forward: EIA estimates based on propane sold for residential and commercial use by state, published by the American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table B.

LGICPZZ — LPG consumed by the industrial sector.

- 1960 through 2007: Calculated in SEDS.
- 2008 forward: Estimated by EIA, based on U.S. product supplied, EIA *Petroleum Supply Annual* and data on ethylene feed slate capacity and

normal butane demand from the *Oil and Gas Journal*.

LGRCZZ — Residential sector share of residential and commercial sales of LPG.

- 1960 through 2002: EIA estimates based on the residential and commercial shares of propane used by the residential and commercial sectors published by the American Petroleum Institute.
- 2003 through 2007: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table 3.
- 2008 forward: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table B.

LGTCBUS — LPG total consumed in the United States, in billion Btu.

- 1960 through 1972: EIA, *Annual Energy Review*, Table 5.12.
- 1973 forward: EIA, *Monthly Energy Review*, Table 3.6.

LGTCBUS — Factor for converting LPG from physical units to Btu.

- 1960 through 1966: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Crude Petroleum and Petroleum Products, 1956," Table 4 footnote, constant value of 4.011 million Btu per barrel.
- 1967 forward: Calculated annually by EIA as a weighted average by multiplying the quantity consumed of each of the component products by each product's conversion factor and dividing the sum of those heat contents by the sum of the quantities consumed. The component products are ethane (including ethylene), propane (including propylene), normal butane (including butylene), butane-propane mixtures, ethane-propane mixtures, and isobutane. Their heat content conversion factors are listed in Appendix B beginning on page 181. Quantities consumed are from:
 - 1967 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
 - 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied."
 - The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Table TN4.3. Percentages used to disaggregate Maryland and D.C. combined LPG sales data, 1960 through 2007

Sales Category	Maryland	D.C.
Residential and commercial	99.9%	0.1%
Internal combustion engine fuel	98.9%	1.1%
Industrial	99.4%	0.6%
Chemical	100.0%	0.0%
Utility gas	100.0%	0.0%
Miscellaneous	100.0%	0.0%

LGTCBUS — LPG total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

LGTRBUS — The transportation sector share of LPG internal combustion engine sales.

- EIA estimates based on the LPG portion of the special fuels used on highways published by the U.S. Department of Transportation, Federal Highway Administration (variable MGSFPUS in SEDS), as a percentage of the LPG sold for internal combustion engine use published by the American Petroleum Institute (variable LGCBMUS in SEDS). For an explanation of the estimation method, see Note 2, on page 52.

LGTPZZ — LPG total sales for all uses by state.

Note: Data for Maryland and the District of Columbia are combined for all years. The method for disaggregating the data is explained in Note 1, on page 52.

- 1960 through 1967: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Liquefied Petroleum Gases and Ethane." The specific tables are:
 - 1960 and 1961: Table 5 (data called "Shipments").
 - 1962 through 1966: Table 2 (data called "Consumption").

Table TN4.4. Transportation sector share of LPG internal combustion engine use, 1960 forward

Year	LGTRSUS	Year	LGTRSUS	Year	LGTRSUS
1960	0.229	1979	0.536	1998	0.592
1961	0.258	1980	0.380	1999	0.364
1962	0.266	1981	0.671	2000	0.215
1963	0.273	1982	0.579	2001	0.204
1964	0.259	1983	0.578	2002	0.325
1965	0.290	1984	0.631	2003	0.403
1966	0.325	1985	0.440	2004	0.365
1967	0.368	1986	0.456	2005	0.513
1968	0.389	1987	0.375	2006	0.496
1969	0.341	1988	0.437	2007	0.370
1970	0.363	1989	0.428	2008	0.796
1971	0.423	1990	0.471	2009	0.629
1972	0.392	1991	0.426	2010	0.666
1973	0.384	1992	0.425	2011	0.733
1974	0.381	1993	0.443	2012	0.651
1975	0.406	1994	0.734	2013	0.834
1976	0.440	1995	0.416	2014	0.865
1977	0.478	1996	0.337		
1978	0.594	1997	0.278		

– 1967: Table 2 (data called “Shipments”).

- 1968 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Sales of Liquefied Petroleum Gases and Ethane,” Table 2.
- 1976 through 1980: EIA, *Energy Data Reports*, “Sales of Liquefied Petroleum Gases and Ethane,” Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, “Sales of Liquefied Petroleum Gases and Ethane,” Table 3.
- 1983: EIA estimates.

Note: For 1984 forward, some data are adjusted and estimated by EIA. (See explanation in Note 7, on page 53).

- 1984 through 1988: American Petroleum Institute, *1990 Sales of Natural Gas Liquids and Liquefied Refinery Gases*, pages 24 through 33.
- 1989 through 1991: American Petroleum Institute, *1992 Sales of Natural Gas Liquids and Liquefied Refinery Gases*, pages 4, 5, 18, and 19.
- 1992 through 2007: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table 3.

Table TN4.5. State shares of the total U.S. LPG sold for chemical use, 1960 through 1978

State	Percent	State	Percent
Alabama	0.000	Montana	0.000
Alaska	0.589	Nebraska	0.000
Arizona	0.000	Nevada	0.000
Arkansas	0.000	New Hampshire	0.000
California	2.667	New Jersey	2.040
Colorado	0.232	New Mexico	0.603
Connecticut	0.053	New York	0.000
Delaware	0.811	North Carolina	0.327
District of Columbia	0.000	North Dakota	0.000
Florida	0.000	Ohio	1.103
Georgia	0.699	Oklahoma	0.309
Hawaii	0.000	Oregon	0.000
Idaho	0.000	Pennsylvania	0.354
Illinois	7.066	Rhode Island	0.000
Indiana	0.243	South Carolina	0.021
Iowa	0.900	South Dakota	0.000
Kansas	0.451	Tennessee	0.000
Kentucky	2.548	Texas	57.425
Louisiana	20.566	Utah	0.000
Maine	0.012	Vermont	0.000
Maryland	0.050	Virginia	0.025
Massachusetts	0.009	Washington	0.000
Michigan	0.151	West Virginia	0.286
Minnesota	0.000	Wisconsin	0.000
Mississippi	0.315	Wyoming	0.091
Missouri	0.054	United States	100.000

Lubricants

Physical units

Three data series are used to estimate state consumption of lubricants. The two state-level sales data series are used to apportion the U.S. total consumption data to the states and the end-use sectors within the states. ("ZZ" in the variable names represents the two-letter state code that differs for each state):

LUINPZZ	=	lubricants sold to the industrial sector, in thousand barrels;
LUTRPZZ	=	lubricants sold to the transportation sector, in thousand barrels; and
LUTCPUS	=	lubricants total consumed in the United States, in thousand barrels.

Data for the first two variables are developed from the U.S. Census Bureau reports "Sales of Lubricating and Industrial Oils and Greases" in the *Current Industrial Reports* series. These series were discontinued in 1977 and the method of estimation for 1978 forward is explained in Note 1 at the end of this "Lubricants" section. The third variable for lubricants is the product supplied data series in the U.S. Energy Information Administration's (EIA) *Petroleum Supply Annual*. The first two variables are used for apportioning the third into state total consumption and state end-use consumption estimates.

Total sales of lubricants for each state, LUTTPZZ, is created by adding the industrial and transportation sales:

$$\text{LUTTPZZ} = \text{LUINPZZ} + \text{LUTRPZZ}$$

U.S. sales totals are calculated by summing the state sales data.

Each state's proportion of total U.S. sales is used to calculate each state's estimated consumption of lubricants:

$$\text{LUTCPZZ} = (\text{LUTTPZZ} / \text{LUTTPUS}) * \text{LUTCPUS}$$

Each state's estimated total consumption of lubricants is further divided into end-use estimates in proportion to that state's sales by sector as a portion of total sales in the state. Lubricants consumed by state for industrial use, LUICPZZ, and for transportation use, LUACPZZ, are calculated:

$$\begin{aligned}\text{LUICPZZ} &= (\text{LUINPZZ} / \text{LUTTPZZ}) * \text{LUTCPZZ} \\ \text{LUACPZZ} &= (\text{LUTRPZZ} / \text{LUTTPZZ}) * \text{LUTCPZZ}\end{aligned}$$

Table TN4.6. Lubricants sales data used in consumption estimates

Year of sales data	Year of consumption estimates
1960	1960 and 1961
1962	1962, 1963, and 1964
1965	1965 and 1966
1967	1967 and 1968
1969	1969 and 1970
1971	1971 and 1972
1973	1973 and 1974
1975	1975 and 1976
1977	1977 forward

The consumption of lubricants in the United States by these two end-use sectors is created by summing the state estimates.

British thermal units (Btu)

Lubricants have a heat content value of approximately 6.065 million Btu per barrel. This factor is applied to convert lubricants estimated consumption from physical units to Btu:

$$\begin{aligned}\text{LUICBZZ} &= \text{LUICPZZ} * 6.065 \\ \text{LUACBZZ} &= \text{LUACPZZ} * 6.065\end{aligned}$$

The state total consumption in Btu is the sum of the two sectors' consumption in Btu:

$$\text{LUTCBZZ} = \text{LUICBZZ} + \text{LUACBZZ}$$

The U.S. sector and total consumption estimates in Btu are calculated as the sum of the state data.

Additional notes

1. The lubricants sales data (LUINPZZ and LUTRPZZ) were published approximately every other year by the U.S. Census Bureau until the discontinuation of the series after 1977. Each year's sales data have been used to calculate that year's and at least one other year's consumption estimates. Table TN4.6 specifies which years of consumption estimates depend on which years of the sales data.
2. The sales data from the source document for LUINPZZ and LUTRPZZ are available in incompatible units. The industrial series, LUINPZZ, is oils and greases sold for industrial lubricating and other uses measured in thousand gallons. The transportation series, LUTRPZZ, is oils and greases sold for automotive and aviation uses measured in thousand

pounds. Prior to use in SEDS, these were converted to thousand barrels by dividing the oil data by 42 gallons per barrel and dividing the greases data by 300 pounds per barrel. In the source document, some state data are not published to avoid disclosing figures for individual companies. The undisclosed data were entered as zero in SEDS.

Data sources

LUINPZZ — Lubricants sold to the industrial sector by state. Calculated from:

- U.S. Department of Commerce, Census Bureau, *Current Industrial Reports*, “Sales of Lubricating and Industrial Oils and Greases,” for 1960, 1962, 1965, 1967, 1969, 1971, 1973, 1975, and 1977. (See explanation in Notes 1 and 2, on page 57.)

LUTCPUS — Lubricants total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Petroleum Statement, Annual,” Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, “Petroleum Statement, Annual,” Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled “Products Supplied.” The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

LUTRPZZ — Lubricants sold to the transportation sector by state. Calculated from:

- U.S. Department of Commerce, Census Bureau, *Current Industrial Reports*, “Sales of Lubricating and Industrial Oils and Greases,” for 1960, 1962, 1965, 1967, 1969, 1971, 1973, 1975, and 1977. (See explanation in Notes 1 and 2, on page 57.)

Motor Gasoline

Physical units

Twelve data series are used to estimate the state end-use consumption of motor gasoline. Eleven of the series are from the U.S. Department of Transportation, Federal Highway Administration publication, *Highway Statistics*, and represent sales of motor gasoline. The sales data are categorized as sales for highway and non-highway use:

- **Highway use** sales data (MGMFP) are from the Highway Statistics Table 8.4.2 (previously Table MF-21); however, they are reduced by the amount of highway “special fuels” (MGSFP) used in each state each year as reported on Table 8.4.2. Special fuels are primarily diesel fuels, not motor gasoline, and are included in the transportation sector of distillate fuel oil and other energy sources.
- **Non-highway use** sales are further subdivided into sales for: (1) state, county, and municipal non-highway use of motor fuel (MGPNP) from Table 8.4.2, and (2) private and commercial use. Data for the components of private and commercial non-highway use are reported in Table 8.4.3 (previously Table MF-24):
 - agricultural use (MGAGP)
 - industrial and commercial use (MGIYP)
 - construction use (MGCUP)
 - marine use (MGMRP), through 2014
 - boating use (MGBTP), 2015 forward
 - lawn and garden use (MGLGP), 2015 forward
 - recreational vehicle use (MGRVP), 2015 forward
 - miscellaneous use (MGMSP)

Another component of the private and commercial non-highway series is aviation gasoline (AVNMM), which is discussed under the “Aviation Gasoline” section of this documentation.

The twelfth motor gasoline data series (MGTCPUS) is the total U.S. consumption of motor gasoline published in the product supplied series in the U. S. Energy Information Administration publication *Petroleum Supply Annual*. It includes fuel ethanol blended into motor gasoline. Prior to 1993, motor gasoline product supplied was underreported because the reporting system was not collecting all fuel ethanol blending and there was a misreporting of motor gasoline blending components that were blended into finished motor gasoline. To adjust for the underreporting, fuel ethanol consumption was added to total energy consumption by end-use before 1993 (see Section 7).

The twelve motor gasoline data series are ("ZZ" in the variable names represent the two-letter state code that differs for each state):

MGAGPZZ	=	motor gasoline sold for agricultural use in each state, in thousand gallons;
MGBTPZZ	=	motor gasoline sold for boating use in each state, in thousand gallons;
MGCUPZZ	=	motor gasoline sold for construction use in each state, in thousand gallons;
MGYIPZZ	=	motor gasoline sold for industrial and commercial use in each state, in thousand gallons;
MGLGPZZ	=	motor gasoline sold for lawn and garden use in each state, in thousand gallons;
MGMFPZZ	=	motor fuel sold for highway use in each state, in thousand gallons;
MGMRPZZ	=	motor gasoline sold for marine use in each state, in thousand gallons (through 2014);
MGMSPPZZ	=	motor gasoline sold for miscellaneous and unclassified uses in each state, in thousand gallons;
MGPNPZZ	=	motor fuel sold for public non-highway use in each state, in thousand gallons;
MGRVPZZ	=	motor gasoline sold for recreational vehicle use in each state, in thousand gallons;
MGSFPZZ	=	special fuels (primarily diesel fuel with small amounts of liquefied petroleum gases) sold in each state, in thousand gallons; and
MGTCPPUS	=	motor gasoline total consumed in the United States, in thousand barrels.

U.S. totals for the eight state-level series named above are calculated as the sum of the state data.

The transportation sector accounts for most of the motor gasoline sales. Before 2015, sales to the transportation sector is estimated to be the sum of motor fuel sales for marine use and for highway use (minus the sales of special fuels, which are primarily diesel fuels and are accounted for in the transportation sector of distillate fuel oil). Sales of motor gasoline to the transportation sector in each state (MGTRPZZ) is calculated:

$$\text{MGTRPZZ} = \text{MGMFPZZ} + \text{MGMRPZZ} - \text{MGSFPZZ}$$

Beginning in 2015, marine use is no longer available to calculate MGTRPZZ and two new sales categories, boating use (MGBTP) and recreational vehicle

use (MGRVP), are now included in the definition of transportation sector sales:

$$\text{MGTRPZZ} = \text{MGMFPZZ} + \text{MGBTPZZ} + \text{MGRVPZZ} - \text{MGSFPZZ}$$

Before 2015, two sales data series are added to estimate motor gasoline sales to the commercial sector: miscellaneous (including unclassified) and public non-highway sales. Sales of motor gasoline to the commercial sector in each state (MGCMPZZ) is calculated:

$$\text{MGCMPZZ} = \text{MGMSPPZZ} + \text{MGPNPZZ}$$

Beginning in 2015, a new sales category, lawn and garden use (MGLGP), is allocated to commercial sector sales:

$$\text{MGCMPZZ} = \text{MGMSPPZZ} + \text{MGPNPZZ} + \text{MGLGPZZ}$$

Sales of motor gasoline for use in the industrial sector in each state (MGINPZZ) is calculated as the sum of the sales for agricultural use, for construction use, and for industrial and commercial use:

$$\text{MGINPZZ} = \text{MGAGPZZ} + \text{MGCUPZZ} + \text{MGYIPZZ}$$

Total sales of motor gasoline in each state (MGTPPZZ) is calculated as the sum of the sales to the major sectors:

$$\text{MGTPPZZ} = \text{MGCMPZZ} + \text{MGINPZZ} + \text{MGTRPZZ}$$

U.S. totals for the three end-use sectors' sales and for total sales are calculated as the sum of the states' sales.

The motor gasoline sales data for the three end-use sectors in each state are used to apportion the U.S. total consumption of motor gasoline to the states and to the major end-use sectors within each state.

The estimated consumption of motor gasoline in each state is calculated according to each state's share of the total sales. Estimated consumption of motor gasoline in each state (MGTCPPZZ) is calculated:

$$\text{MGTCPPZZ} = (\text{MGTPPZZ} / \text{MGTPPUS}) * \text{MGTCPPUS}$$

The commercial sector estimated consumption of motor gasoline (MGCCPZZ) is calculated:

$$\text{MGCCPZZ} = (\text{MGCMPZZ} / \text{MGTPPZZ}) * \text{MGTCPPZZ}$$

The industrial sector estimated consumption (MGICPZZ) is calculated:

$$\text{MGICPZZ} = (\text{MGINPZZ} / \text{MGTPPZZ}) * \text{MGTCPPZZ}$$

The transportation sector estimated consumption (MGACPZZ) is calculated:

$$\text{MGACPZZ} = (\text{MGTRPZZ} / \text{MGTPPZZ}) * \text{MGTCPZZ}$$

The consumption of motor gasoline by major end-use sector in the United States is estimated by summing the states' estimated consumption.

British thermal units (Btu)

A national factor, MGTCCKUS, is used to convert motor gasoline consumption from physical units to British thermal units for each state. A constant heat content of 5.253 million Btu per barrel is used for 1960 through 1992. Beginning in 1993, an annual average factor is calculated by EIA. The factors, listed in Table B1 on page 167, are used for each state:

$$\text{MGCCBZZ} = \text{MGCCPZZ} * \text{MGTCCKUS}$$

$$\text{MGICBZZ} = \text{MGICPZZ} * \text{MGTCCKUS}$$

$$\text{MGACBZZ} = \text{MGACPZZ} * \text{MGTCCKUS}$$

Total Btu consumption of motor gasoline is the sum of the consumption by the commercial, industrial, and transportation sectors.

$$\text{MGTCBZZ} = \text{MGCCBZZ} + \text{MGICBZZ} + \text{MGACBZZ}$$

The U.S. level Btu consumption estimates are calculated by summing the state data.

Additional note

In 2015, the Federal Highway Administration has revised its methods of estimating non-highway use of motor gasoline. Estimates from 2015 forward are not compatible with data before 2015.

Additional calculations

To assist data users in the analysis of consumption of renewable energy sources, which include fuel ethanol, versus non-renewable energy sources, which include motor gasoline, a new data series, motor gasoline excluding fuel ethanol, is created for each state and the United States: Prior to 1993, fuel ethanol was not included in the motor gasoline data series from the source:

$$\text{MMTCB} = \text{MGTCB}$$

From 1993 forward:

$$\text{MMTCB} = \text{MGTCB} - \text{EMTCB}$$

EMTCB is fuel ethanol minus denaturant. See discussion on fuel ethanol in Section 5, "Renewable Energy."

Motor gasoline excluding fuel ethanol is used only in the tables showing energy consumption by source. For consumption by end-use sector, motor gasoline is defined as the product consumed by the end-users, that is, including fuel ethanol.

Data sources

MGAGPZZ — Motor gasoline sold for agricultural use by state.

- 1960 through 1964: U.S. Department of Commerce, Bureau of Public Roads, *Highway Statistics*, Table G-24.
- 1965 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table G-24 in 1965, Table MF-24 (1966 through 2006), and Table 8.4.3 (2007 forward).

MGBTPZZ — Motor gasoline sold for boating use by state.

- 2015 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table 8.4.3.

MGCUPZZ — Motor gasoline sold for construction use by state.

- 1960 through 1964: U.S. Department of Commerce, Bureau of Public Roads, *Highway Statistics*, Table G-24.
- 1965 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table G-24 in 1965, Table MF-24 (1966 through 2006), and Table 8.4.3 (2007 forward).

MGIYPZZ — Motor gasoline sold for industrial and commercial use by state.

- 1960 through 1964: U.S. Department of Commerce, Bureau of Public Roads, *Highway Statistics*, Table G-24.
- 1965 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table G-24 in 1965, Table MF-24 (1966 through 2006), and Table 8.4.3 (2007 forward).

MGLGPZZ — Motor gasoline sold for lawn and garden use by state.

- 2015 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table 8.4.3.

MGMFPZZ — Motor fuel sold for highway use by state.

- 1960 through 1995: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics Summary to 1995*, Table MF-221 gives revised U.S. totals. State revisions can be calculated by adding data from Tables MF-225 and MF-226.
- 1996 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table MF-21 (1996 through 2006) and Table 8.4.2 (2007 forward).

MGMRPZZ — Motor gasoline sold for marine use by state.

- 1960 through 1964: U.S. Department of Commerce, Bureau of Public Roads, *Highway Statistics*, Table G-24.
- 1965 through 2014: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table G-24 in 1965, Table MF-24 (1966 through 2006), and Table 8.4.3 (2007 through 2014).

MGMSPZZ — Motor gasoline sold for miscellaneous uses by state.

- 1960 through 1964: U.S. Department of Commerce, Bureau of Public Roads, *Highway Statistics*, Table G-24. Sum of the “Miscellaneous” column plus the “Unclassified” column minus the “Total Classified” column.
- 1965: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, Table G-24. Sum of the “Miscellaneous” column plus the “Unclassified” column minus the “Total Classified” column.
- 1966 through 1981: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table MF-24, sum of the “Miscellaneous” and the “Unclassified” columns.
- 1982 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table MF-24 (1982 through 2006) and Table 8.4.3 (2007 forward), the “Miscellaneous” column.

MGPNPZZ — Motor fuel sold for public non-highway use by state.

- 1960 through 1964: U.S. Department of Commerce, Bureau of Public Roads, *Highway Statistics*, Table G-21.
- 1985, 1987, and 1992: Unpublished revised state data comparable to the U.S. values published in *Highway Statistics Summary to 1995*, Table 221.
- 1965 through 1984, 1986, 1988 through 1991, and 1993 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table G-21 in 1965, Table MF-21 (1996 through 2006), and Table 8.4.2 (2007 forward).

MGRVPZZ — Motor gasoline sold for recreational vehicle use by state.

- 2015 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table 8.4.3.

MGSFPZZ — Special fuels sales by state (primarily diesel fuel with small amounts of liquefied petroleum gases).

- 1960 through 1995: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics, Summary to 1995*, Table MF-225.
- 1996 forward: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table MF-21 (1996 through 2006) and Table 8.4.2 (2007 forward).

MGTKUS — Factor for converting motor gasoline from physical units to Btu.

- 1960 through 1992: EIA adopted the Bureau of Mines thermal conversion factor of 5.253 million Btu per barrel for “Gasoline, Motor Fuel” as published by the Texas Eastern Transmission Corporation in Appendix V of *Competition and Growth in American Energy Markets 1947-1985*, a 1968 release of historical and projected statistics. The factor excludes oxygenates.
- 1993 forward: EIA calculates the national annual average thermal conversion factor, which includes fuel ethanol blended into motor gasoline (shown in Appendix B Table B1 on page 167). For 1993-

2006, it also includes methyl tertiary butyl ether (MTBE) and other oxygenates blended into motor gasoline.

MGTCPU — Motor gasoline total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*. "Petroleum Statement, Annual," Table 1.

For 1960 through 1963, motor gasoline was combined with aviation gasoline and published as "gasoline" in the source table. Table 19 in the "Petroleum Statement, Annual" titled "Salient Statistics of Aviation Gasoline" provided separate data for aviation gasoline for those years. The aviation gasoline data from the second table were subtracted from the gasoline data in the first table to derive the motor gasoline consumption series used in SEDS.

- 1976 through 1980: EIA, *Energy Data Reports*. "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Petroleum Coke

In the State Energy Data System (SEDS) consumption tables, petroleum coke is included in the category "other petroleum products" (see descriptions beginning on page 71 and summary table on page 30).

Physical units

Seven data series are used to estimate the consumption of petroleum coke. Five are measures of petroleum coke consumption and two are indicators of industrial activity used to apportion U.S. industrial petroleum coke consumption to the states. ("ZZ" in the variable name represents the two-letter state code that differs for each state):

PCTCPU	=	petroleum coke total consumed in the United States, in thousand barrels;
PCEIMZZ	=	petroleum coke consumed by the electric power sector in each state, in thousand short tons;
PCC3MZZ	=	petroleum coke consumed for combined heat and power in the commercial sector in each state, in thousand short tons;
PCI3MZZ	=	petroleum coke consumed for combined heat and power in the industrial sector in each state, in thousand short tons;
PCRFPZZ	=	petroleum coke used at refineries as both catalytic and marketable coke in each state, or group of states, or Petroleum Administration for Defense (PAD) district, in thousand barrels;
CTCAPZZ	=	catalytic cracking charge capacity of petroleum refineries in each state, in barrels per calendar day (1960 through 1979) and barrels per stream day (1980 forward); and
AICAPZZ	=	aluminum ingot production capacity in each state, in short tons.

The total consumption of petroleum coke in the United States (PCTCPU) is the product supplied series from the U.S. Energy Information Administration (EIA) *Petroleum Supply Annual*.

Information on the amount of petroleum coke consumed for the purpose of generating electricity is available from the EIA, Form EIA-923, "Power Plant Operations Report," and predecessor forms. For the electric power sector (PCEIM), these data are available for 1970 forward. Prior to 1970, consumption

is assumed to be zero. For 1989 forward, the electric power sector includes petroleum coke consumed by electric utilities and independent power producers whose primary business is to sell electricity or electricity and heat. Quantities of petroleum coke used by commercial (PCC3M) and industrial (PCI3M) facilities in combined-heat-and-power units are also available and are included in the commercial and industrial sectors, respectively.

The data for petroleum coke used to generate electricity are in thousand short tons and are converted into thousand barrels in the State Energy Data System (SEDS) by applying a conversion factor of five barrels per short ton, and the U.S. value is the sum of the state data:

$$\begin{aligned} \text{PCEIPZZ} &= \text{PCEIMZZ} * 5 \\ \text{PCEIPUS} &= \sum \text{PCEIPZZ} \\ \text{PCCCPZZ} &= \text{PCC3MZZ} * 5 \\ \text{PCCCPUS} &= \sum \text{PCCCPZZ} \\ \text{PCI3PZZ} &= \text{PCI3MZZ} * 5 \\ \text{PCI3PUS} &= \sum \text{PCI3PZZ} \end{aligned}$$

To estimate U.S. industrial consumption of petroleum coke, U.S. electric power and commercial consumption are subtracted from the total U.S. petroleum coke product supplied:

$$\text{PCICPUS} = \text{PCTCPUS} - \text{PCEIPUS} - \text{PCCCPUS}$$

In addition to combined-heat-and-power generation, petroleum coke is used in the industrial sector as catalyst coke at refineries in a process for increasing the yield of gasoline from crude oil (catalytic cracking) and for other industrial uses (mainly for conversion into electrodes that are consumed in the production of aluminum).

Through 2012, state-level estimates of the refinery consumption of petroleum coke are calculated by assuming that each state consumes petroleum coke in proportion to the catalytic cracking charge capacity (CTCAPZZ) of the refineries in the state. The U.S. total for the state-level data allocating series is calculated by summing the state data.

$$\text{CTCAPUS} = \sum \text{CTCAPZZ}$$

Petroleum coke consumed by refineries for 1960 through 1980 is available for some states while quantities for other states are grouped (G1 through G7 as indicated by GZ in the following formulas). The group quantities are allocated to the states within each group in proportion to each state's portion of the group's catalytic cracking charge capacity. For 1981 forward, PAD district data (P1 through P5 as indicated by PZ in the following formulas) are allocated in

the same way to the states within each district:

$$\begin{aligned} \text{PCRFPZZ} &= \text{PCRFPZZ}, \text{ or} \\ \text{PCRFPZZ} &= (\text{CTCAPZZ} / \text{CTCAPGZ}) * \text{PCRFPGZ} \text{ (1 through 7), or} \\ \text{PCRFPZZ} &= (\text{CTCAPZZ} / \text{CTCAPPZ}) * \text{PCRFPZ} \text{ (1 through 5)} \\ \text{PCRFPUS} &= \sum \text{PCRFPZZ} \end{aligned}$$

Beginning in 2013, SEDS incorporates unpublished state-level refinery fuel consumption data that satisfied two statistical disclosure rules – that there are at least three refineries not of the same company in the state and that no one refinery uses more than 60% of the particular fuel. For petroleum coke, data for eight states are usable. They are subtracted from the PAD district data, and the remainders are allocated to the remaining states using CTCAPZZ.

U.S. petroleum coke used at combined-heat-and-power plants (PCI3PUS) and at refineries (PCRFPUS) are subtracted from the U.S. industrial sector consumption to derive U.S. consumption of petroleum coke for all other industrial uses:

$$\text{PCOCPUS} = \text{PCICPUS} - \text{PCI3PUS} - \text{PCRFPUS}$$

State-level estimates of petroleum coke consumed by other industrial users, mainly aluminum production, are assumed to be in proportion to each state's aluminum ingot production capacity (AICAPZZ). For 1993 forward, state-level aluminum production capacity is adjusted to account for under-utilization of the plants. Although AICAPZZ is measured in short tons, it is not converted to thousand barrels because it is used only as a state-level allocator. The U.S. total is calculated as the sum of the state data and other industrial use of petroleum coke is allocated to the states as follows:

$$\begin{aligned} \text{AICAPUS} &= \sum \text{AICAPZZ} \\ \text{PCOCPZZ} &= (\text{AICAPZZ} / \text{AICAPUS}) * \text{PCOCPUS} \end{aligned}$$

Industrial sector petroleum coke consumption by state is the sum of combined-heat-and-power industrial use, consumption at refineries, and all other industrial uses:

$$\text{PCICPZZ} = \text{PCI3PZZ} + \text{PCRFPZZ} + \text{PCOCPZZ}$$

Total petroleum coke consumption by state is the sum of commercial, industrial, and electric power sector use:

$$\text{PCTCPZZ} = \text{PCCCPZZ} + \text{PCICPZZ} + \text{PCEIPZZ}$$

British thermal units (Btu)

Two series are used to convert petroleum coke from physical unit values to Btu:

PCCTKUS	=	factor for converting catalyst petroleum coke from physical units to Btu; and
PCMKKUS	=	factor for converting marketable petroleum coke from physical units to Btu.

For 2004 forward, PCCTKUS adopts a fixed value of 6.287 million Btu per barrel and PCMKKUS adopts a fixed value of 5.719 million Btu per barrel. For 1960 through 2003, a fixed factor of 6.024 million Btu per barrel is used for both series. See explanation in Appendix B.

These factors are applied to convert estimated petroleum coke consumption from physical units to Btu by state:

PCCCBZZ	=	PCCCPZZ * PCMKKUS
PCI3BZZ	=	PCI3PZZ * PCMKKUS
PCOCBZZ	=	PCOCPZZ * PCMKKUS
PCRFBZZ	=	PCRFPZZ * PCCTKUS
PCEIBZZ	=	PCEIPZZ * PCMKKUS

Petroleum coke consumed in the industrial sector is the sum of:

$$PCICBZZ = PCI3BZZ + PCRFBZZ + PCOCBZZ$$

Total Btu consumption of petroleum coke is the sum of the consumption by the end-use sectors and for electricity generation:

$$PCTCBZZ = PCCCBZZ + PCICBZZ + PCEIBZZ$$

The U.S. totals are the sum of the states' values.

Additional notes

The source for petroleum coke used at refineries, PCRFPUS and PCRFPZ, is the EIA *Petroleum Supply Annual* and predecessor reports. For 1960 through 1980, the data are provided in thousand short tons. For consistency with later years' data, the 1960 through 1980 data are first converted into thousand barrels before being used in SEDS. For 1960 through 1967, the data are published for Texas and New Mexico and for groups of other states. For 1968 through 1980, the data are given for 19 individual states with the remaining states are combined into seven groups. The data for 1960 through 1967 are disaggregated into the 19 states and seven groups used for the later years,

prior to being entered into SEDS, by using the proportions of the 1968 data, which was published in both formats. For 1981 forward, the data are published by PAD districts only. For 2013 forward, unpublished state-level data that satisfied statistical disclosure rules are incorporated in SEDS.

Data sources

AICAPZZ — Aluminum ingot production capacity in each state.

- 1960 through 1973: American Bureau of Metal Statistics, *Year Book*.
- 1974 through 1994: American Bureau of Metal Statistics, *Non-Ferrous Metal Data*, table titled "Aluminum Ingot Production Capacity." Note: Capacities for individual plants owned by one company have been withheld since 1986. The company's total capacity has been apportioned to the individual plants on the basis of their proportional capacities in 1985.
- 1995 forward: U.S. Department of the Interior, U.S. Geological Survey, *Minerals Yearbook*.

CTCAPZZ — Catalytic cracking charge capacity of petroleum refineries by state.

- 1960: Data are unavailable from published reports. The 1961 values are used for 1960.
- 1961 through 1963: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Refineries in the United States." The specific tables are:
 - 1961 and 1962: Table 7, under "Cracking Capacity" column heading "Charge."
 - 1963: Table 6, under "Catalytic-Cracking Capacity" column heading "Charge."
- 1964 through 1976: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Refineries in the United States and Puerto Rico," Table 2, all entries next to "Cat. Ck." summed by state.
- 1977: EIA, *Energy Data Reports*, "Petroleum Refineries in the United States and Puerto Rico," Table 2, all entries next to "Cat. Ck." summed by state.
- 1978: EIA, *Energy Data Reports*, "Petroleum Refineries in the United States and U.S. Territories," Table 2, all entries next to "Cat. Ck." summed by state.
- 1979 and 1980: EIA, *Energy Data Reports*, "Petroleum Refineries in the United States and U.S. Territories." The specific tables are:

- 1979: Table 2, sum of “Catalytic Cracking” columns, “Fresh” and “Recycle.”
- 1980: Table 1, sum of “Catalytic Cracking (fresh)” and “Catalytic Cracking (recycle)” columns.
- 1981 through 2004: EIA, *Petroleum Supply Annual*, sum of “Catalytic Cracking (Fresh)” and “Catalytic Cracking (Recycled)” columns in the following tables:
 - 1981 through 1983: Table 1.
 - 1984: Table 30.
 - 1985 through 1989: Table 29.
 - 1989 through 1994: Table 36.
 - 1995: Data series became biannual. 1994 data used for 1995.
 - 1996: Table 36.
 - 1997: 1996 data used for 1997.
 - 1998 through 2004: Table 36, http://www.eia.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1_historical.html.
- 2005 forward: EIA, *Refinery Capacity Report*, Table 1, http://www.eia.gov/oil_gas/petroleum/data_publications/refinery_capacity_data/refcap_historical.html.

PCC3MZZ — Petroleum coke consumed for combined heat and power in the commercial sector by state.

- 1960 through 1988: No data available. Values are assumed to be zero.
- 1989 forward: EIA, Form EIA-923, “Power Plant Operations Report,” and predecessor forms.

PCCTKUS — Factor for converting petroleum coke, catalyst coke from physical units to Btu.

- 1960 through 2003: EIA adopted the Bureau of Mines thermal conversion factor of 6.024 million Btu per barrel, from the Bureau of Mines internal memorandum “Bureau of Mines Standard Average Heating Value of Various Fuels, Adopted January 3, 1950.”
- 2004 forward: Assumed by EIA to be 6.287 million Btu per barrel or equal to the thermal conversion factor for residual fuel oil.

PCEIMZZ — Petroleum coke consumed by the electric power sector by state.

- 1960 through 1969: No data available. Values are assumed to be zero.
- 1970 forward: EIA, Forms EIA-923, “Power Plant Operations Report,” and predecessor forms.

PCI3MZZ — Petroleum coke consumed for combined heat and power in the industrial sector by state.

- 1960 through 1988: No data available. Values are assumed to be zero.
- 1989 forward: EIA, Form EIA-923, “Power Plant Operations Report,” and predecessor forms.

PCMKKUS — Factor for converting petroleum coke, marketable coke from physical units to Btu.

- 1960 through 2003: EIA adopted the Bureau of Mines thermal conversion factor of 6.024 million Btu per barrel, from the Bureau of Mines internal memorandum “Bureau of Mines Standard Average Heating Value of Various Fuels, Adopted January 3, 1950.”
- 2004 forward: EIA adopts the thermal conversion factor of 5.719 million Btu per barrel, calculated by dividing 28,595,925 Btu per short ton for petroleum coke (from U.S. Department of Energy, Argonne National Laboratory, “The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model” (GREET), version GREET1_ October 2013) by 5.0 barrels per short ton (as given in the Bureau of Mines Form 6-1300-M and successor EIA forms).

PCRFPZZ, PCRFPZ, or PCRFPZ — Petroleum coke consumed at refineries (both catalyst and marketable) by state or groups of states.

- 1960: No data available. The 1961 value is used for 1960.
- 1961 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Petroleum Statement, Annual.” The specific tables are:
 - 1961 and 1962: Table 18.
 - 1962 through 1966: Table 19.
 - 1967: Table 18.
 - 1968: Table 19.
 - 1969 through 1972: Table 18.
 - 1973 and 1974: Table 21.
 - 1975: Table 22.
- 1976 through 1980: EIA, *Energy Data Reports*, “Petroleum Statement, Annual.” The specific tables are:
 - 1976: Table 22.
 - 1977: Table 21.
 - 1978 through 1980: Table 20.
- 1981 through 2004: EIA, *Petroleum Supply Annual*. The specific tables

are:

- 1981 and 1982: Table 17.
- 1983: Table 15.
- 1984: Table 44.
- 1985: Table 43.
- 1986 through 1988: Table 38.
- 1989 through 1992: Table 45.
- 1995 and 1997: Table 36.
- 1993 and 1994, 1996, and 1998 through 2004: http://www.eia.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1_historical.html, Table 47.

- 2005 forward: EIA, EIA, *Refinery Capacity Report*, Table 12 (2006–2008), Table 12a (2009), and Table 10a (2010 forward), http://www.eia.gov/oil_gas/petroleum/data_publications/refinery_capacity_data/refcap_historical.html. Also available at [http://www.eia.gov/dnav/pet/pet_pnp_capfuel_a_\(na\)_8FPPO_Mbbl_a.htm](http://www.eia.gov/dnav/pet/pet_pnp_capfuel_a_(na)_8FPPO_Mbbl_a.htm).

PCTCPUS — Petroleum coke total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*. “Petroleum Statement, Annual,” Table 1.
- 1976 through 1980: EIA, *Energy Data Report*, “Petroleum Statement, Annual,” Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled “Products Supplied.” The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Residual Fuel Oil

Physical units

Since state-level end-use consumption data for residual fuel oil (with the exception of electric power sector data) are not available, sales of residual fuel oil into or within each state, published by the U.S. Energy Information Administration (EIA) in the *Fuel Oil and Kerosene Sales Report*, are used to estimate residual fuel oil consumption. The following variable names have been assigned to the sales series, in thousand barrels (“ZZ” in the following variable names represents the two-letter state code that differs for each state):

RFBKPZZ	=	residual fuel oil sold for vessel bunkering use (i.e., the fueling of commercial or private boats, such as pleasure craft, fishing boats, tugboats, and ocean-going vessels, including vessels operated by oil companies, and fueling for other marine purposes), excluding sales to the military;
RFCMPZZ	=	residual fuel oil sold to the commercial sector for heating;
RFIBPZZ	=	residual fuel oil sold to industrial establishments for space heating and for other industrial use (i.e., for all uses to mines, smelters, plants engaged in producing manufactured products, in processing goods, and in assembling);
RFMIPZZ	=	residual fuel oil sold to the military, regardless of use;
RFMSPZZ	=	residual fuel oil sold for all other uses not identified in other sales categories;
RFOCPZZ	=	residual fuel oil sold for oil company use, including all fuel oil, crude oil, or acid sludge used as fuel at refineries, by pipelines, or in field operations; and
RFRRPZZ	=	residual fuel oil sold to the railroads for use in fueling trains, operating railroad equipment, space heating of buildings, and other operations.

Two other data series that represent consumption of residual fuel oil are:

RFEIPZZ	=	residual fuel oil consumed by the electric power sector in each state, in thousand barrels; and
RFTCPUS	=	residual fuel oil total supplied in the United States, in thousand barrels.

Residual fuel oil consumed by the electric power sector (RFEIPZZ) is collected by EIA on Form EIA-923, "Power Plant Operations Report," and predecessor forms. (See Note 3 at the end of this residual fuel oil section for further information on changes in this series' data definitions.)

Total U.S. consumption of residual fuel oil, RFTCPUS, is the product supplied series in EIA's publication *Petroleum Supply Annual*.

All state-level data series listed above are summed to provide totals for the United States.

The data series are then combined as closely as possible into the major end-use sectors used in the State Energy Data System (SEDS). No residual fuel oil is sold to the residential sector. Residual fuel oil sales to the commercial sector is the RFCMPZZ series.

The sales of residual fuel oil to the industrial sector in each state, RFINPZZ, is the sum of the residual fuel oil sold for industrial use, including industrial space heating (RFIBPZZ), for oil company use (RFOCPZZ), and for all other uses (RFMSPZZ):

$$\begin{aligned}\text{RFINPZZ} &= \text{RFIBPZZ} + \text{RFOCPZZ} + \text{RFMSPZZ} \\ \text{RFINPUS} &= \sum \text{RFINPZZ}\end{aligned}$$

The sales of residual fuel oil to the transportation sector in each state, RFTRPZZ, is the sum of the residual fuel oil sales for vessel bunkering (RFBKPZZ), military use (RFMIPZZ), and railroad use (RFRRPZZ):

$$\begin{aligned}\text{RFTRPZZ} &= \text{RFBKPZZ} + \text{RFMIPZZ} + \text{RFRRPZZ} \\ \text{RFTRPUS} &= \sum \text{RFTRPZZ}\end{aligned}$$

Sales of residual fuel oil to the commercial, industrial, and transportation sectors are added to create a subtotal of sales to all sectors other than the electric power sector (RFNDPZZ):

$$\begin{aligned}\text{RFNDPZZ} &= \text{RFCMPZZ} + \text{RFINPZZ} + \text{RFTRPZZ} \\ \text{RFNDPUS} &= \sum \text{RFNDPZZ}\end{aligned}$$

The estimated residual fuel oil consumption for the United States by all sectors other than the electric power sector (RFNCPUS) is calculated by subtracting the total residual fuel oil consumption for the electric power sector from the total U.S. residual fuel oil consumption:

$$\text{RFNCPUS} = \text{RFTCPUS} - \text{RFEIPUS}$$

This U.S. subtotal of residual fuel oil consumption by the end-use sectors combined (RFNCPUS) is apportioned to the states by using the states' end-

use sector sales data. The assumption is made that each state consumes residual fuel oil in proportion to the amount sold in that state:

$$\text{RFNCPZZ} = (\text{RFNDPZZ} / \text{RFNDPUS}) * \text{RFNCPUS}$$

The end-use sectors' subtotal for each state is further divided into estimates for each sector in proportion to each sector's sales. The estimated commercial sector consumption in each state, RFCCPZZ, is calculated:

$$\text{RFCCPZZ} = (\text{RFCMPZZ} / \text{RFNDPZZ}) * \text{RFNCPZZ}$$

The industrial sector's estimated consumption in each state, RFICPZZ, is calculated:

$$\text{RFICPZZ} = (\text{RFINPZZ} / \text{RFNDPZZ}) * \text{RFNCPZZ}$$

The transportation sector's estimated consumption in each state, RFACPZZ, is calculated:

$$\text{RFACPZZ} = (\text{RFTRPZZ} / \text{RFNDPZZ}) * \text{RFNCPZZ}$$

The consumption of residual fuel oil in the United States by the major end-use sectors is estimated by adding the states' estimated consumption.

Total state residual fuel oil consumption is the sum of the end-use sectors' consumption subtotal and the electric power sector consumption:

$$\text{RFTCPZZ} = \text{RFNCPZZ} + \text{RFEIPZZ}$$

British thermal units (Btu)

Residual fuel oil has a heat content value of approximately 6.287 million Btu per barrel. This factor is applied to convert residual fuel oil estimated consumption from physical units to Btu as shown in the following example:

$$\text{RFCCBZZ} = \text{RFCCPZZ} * 6.287$$

Total Btu consumption of residual fuel oil is the sum of the consumption by the end-use sectors and for electricity generation:

$$\text{RFTCBZZ} = \text{RFCCBZZ} + \text{RFICBZZ} + \text{RFACBZZ} + \text{RFEIBZZ}$$

The U.S. level Btu consumption estimates are calculated as the sum of the states' Btu consumption.

Additional notes

1. "Sales" data are actually called "shipments" in the source documents

for 1960 and 1961; “consumption” for 1962 through 1966; “shipments” for 1967; “sales” from 1968 through 1978; “deliveries” for 1979 through 1983; and “sales” for 1984 forward.

2. In 1979, the EIA implemented a new survey form, EIA-172, to obtain deliveries of fuel oil and kerosene data and updated the list of respondents. (A detailed explanation is published in the *Energy Data Report*, “Deliveries of Fuel Oil and Kerosene in 1979.”) In the new survey form, certain end-use categories were redefined—in many cases, to collect more disaggregated data. The reclassifications resulted in some end-use categories that were no longer comparable with those in previous surveys. Where discontinuities occurred, estimates for the pre-1979 years have been made in SEDS to conform with the 1979 fuel oil deliveries classifications. The pre-1979 deliveries estimates are not published in this report but are used in SEDS to disaggregate the known U.S. total product supplied (consumption) into state and major end-use sector consumption estimates.

For residual fuel oil deliveries in 1979, the end-use categories “commercial” and “industrial” are available. The pre-1979 deliveries categories are called “heating” and “industrial.” While the pre-1979 categories individually are not continuous with the 1979 categories, their subtotals are related. That is, a general comparison can be made between the sum of commercial and industrial deliveries in 1979 and the sum of heating and industrial deliveries in the pre-1979 years. Therefore, the following method was applied to present a comparable series for residual fuel oil delivered to the commercial and industrial sectors:

- For each of the pre-1979 years, a subtotal was created for each state by adding each state’s heating and industrial deliveries categories. A comparable 1979 subtotal was created by adding each state’s commercial and industrial deliveries categories.
- Commercial and industrial shares of the subtotal in 1979 were calculated for each state.
- These 1979 end-use shares were then applied to each pre-1979 subtotal of residual fuel oil deliveries in each state to create state estimates of end-use deliveries for 1960 through 1978.

The 1980 through 1982 residual fuel oil deliveries data are based on the same survey as that used for 1979; therefore, the 1980 through 1982 data are directly comparable to 1979 data.

In 1984, EIA again updated the list of respondents for this survey, and the Form EIA-172 became the Form EIA-821, “Annual Fuel Oil and Kerosene Sales Report.” EIA did not conduct a fuel oil and kerosene sales survey

for 1983. The 1983 estimates in SEDS are based on 1984 data obtained from the Form EIA-821. Statistical procedures and methodologies used for the Form EIA-821 differ from those used in previous years. Therefore, the 1983 and forward sales data may not be directly comparable to the pre-1983 data. (In the source document, the sales data for 1983 forward are reported in thousand gallons. These data were first converted to thousand barrels before being entered into SEDS.)

3. The data on fuel oil consumed by the electric power sector for all years and states are actual fuel oil consumption numbers collected from electric power plants on Form EIA-923, “Power Plant Operations Report,” and predecessor forms. Due to changes in fuel oil reporting classifications on the predecessor forms over the years, it is not possible to develop a thoroughly consistent series for all years. However, over time, data more accurately disaggregating fuel oil into distillate fuel oil and residual fuel oil have become available. For 1960 through 1969, only data on total fuel oil consumed at electric utilities by state are available. For 1970 through 1979, fuel oil consumed by plant type (internal combustion and gas turbine plants combined and steam plants) by state are available. For 1980 through 2000, data on consumption of light oil at all plant types combined and consumption of heavy oil at all plant types combined are available by state. For 2001 forward, data on consumption of distillate fuel oil and residual fuel oil are available. In SEDS, the following assumptions have been made:
 - 1960 through 1969—state estimates of fuel oil consumption by plant type have been created for each year by applying the shares of steam plants (primarily residual fuel oil) and internal combustion and gas turbine plants (primarily distillate fuel oil plus small amounts of jet kerosene) by state in 1970 to each year’s total fuel oil consumption at electric utilities for 1960 through 1969.
 - 1970 through 1979—fuel oil consumed by steam plants is assumed to equal residual fuel oil consumption, and fuel oil consumed by internal combustion and gas turbine plants is assumed to equal distillate fuel oil plus jet kerosene consumption.
 - 1980 through 2000—total heavy oil consumption at all plant types is assumed to equal residual fuel oil consumption, and total light oil consumption at all plant types is assumed to equal distillate fuel oil plus jet kerosene consumption.

The data series thus derived for SEDS for residual fuel oil and distillate fuel oil consumption by the electric power sector is considered to be actual consumption by the electric power sector for each state and each year.

Data sources

RFBKPZZ — Residual fuel oil sold for vessel bunkering use by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Shipments of Fuel Oil and Kerosene.” The specific tables are:
 - 1960 and 1961: Table 17.
 - 1962 and 1963: Table 16.
 - 1964 and 1965: Table 15.
 - 1966 through 1975: Table 11.
- 1976 through 1978: EIA, *Energy Data Reports*, “Sales of Fuel Oil and Kerosene,” Table 11.
- 1979 and 1980: EIA, *Energy Data Reports*, “Deliveries of Fuel Oil and Kerosene,” Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 5.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A13.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VVB_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VVB_Mgal_a.htm.

RFCMPZZ — Residual fuel oil sold to the commercial sector for heating.

- 1960 through 1978: EIA estimates based on statistics of commercial sector deliveries of residual fuel oil from the EIA, *Energy Data Report*, “Deliveries of Fuel Oil and Kerosene in 1979,” Table 2. State ratios based on 1979 commercial sector deliveries were applied to each state’s sum of heating plus industrial deliveries categories from the fuel oil deliveries reports for each year 1960 through 1978. (See explanation in Note 2, on page 68.)
- 1979 and 1980: EIA, *Energy Data Report*, “Deliveries of Fuel Oil and Kerosene,” Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 5.

Notes: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS. Data for Hawaii in 1986 through 1990 reflect unpublished revisions from an EIA internal memorandum from the Office of Oil and Gas to the

Office of Energy Markets and End Use, “Revising Historical Petroleum Data,” February 26, 1993.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A13.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VCS_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VCS_Mgal_a.htm.

RFEIPZZ — Residual fuel oil consumed by the electric power sector.

- EIA, Form EIA-923, “Power Plant Operations Report,” and predecessor forms. The following assumptions have been made:
 - 1960 through 1969: Only total fuel oil consumed at electric utilities by state is available. State estimates of residual fuel oil consumption were created for each year by applying the shares of steam plants (primarily residual fuel oil) by state from 1970 to each year’s total fuel oil consumption at electric utilities for 1960 through 1969.
 - 1970 through 1979: Fuel oil consumed by plant type by state is available. Fuel oil consumed by steam plants is assumed to equal residual fuel oil consumption.
 - 1980 through 2000: Consumption of heavy fuel at all plant types by state is available. This is assumed to equal residual fuel oil consumption.
 - 2001 forward: Consumption of residual fuel oil is available.

RFIBPZZ — Residual fuel oil sold to industrial establishments for heating and for other industrial use.

- 1960 through 1978: EIA, estimates based on statistics of industrial sector deliveries of residual fuel from the EIA, *Energy Data Report*, “Deliveries of Fuel Oil and Kerosene in 1979,” Table 2. State ratios based on 1979 industrial sector deliveries were applied to each state’s sum of heating plus industrial deliveries categories from the fuel oil deliveries reports for each year 1960 through 1978. (See explanation in Note 2, on page 68.)
- 1979 and 1980: EIA, *Energy Data Report*, “Deliveries of Fuel Oil and Kerosene,” Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 5.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A13.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_vin_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_vin_Mgal_a.htm.

RFMIPZZ — Residual fuel oil sold to the military regardless of use by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 and 1961: Table 18.
 - 1962 and 1963: Table 17.
 - 1964 and 1965: Table 16.
 - 1966 through 1975: Table 12.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 12.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 5.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A13.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VMI_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VMI_Mgal_a.htm.

RFMSPZZ — Residual fuel oil sold for miscellaneous uses by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are—1960 through 1962: Table 19.
 - 1963 and 1964: Table 18.
 - 1965 through 1967: Table 17.
 - 1968 through 1975: Table 14.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 14.

- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 2, column "Other."
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 5, column "All Other."

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS. The data series is titled "All Other."

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A13.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VOE_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VOE_Mgal_a.htm.

RFOCPZZ — Residual fuel oil sold for use by oil companies by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Shipments of Fuel Oil and Kerosene." The specific tables are:
 - 1960 and 1961: Table 14.
 - 1962 and 1963: Table 13.
 - 1964 and 1965: Table 12.
 - 1966 through 1975: Table 9.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 9.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 5.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983: EIA, *Petroleum Marketing Monthly*, July 1985 issue, Table A13.
- 1984 through 1987: EIA, *Petroleum Marketing Monthly*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VOC_Mgal_a.htm.
- 1988 forward: EIA, *Fuel Oil and Kerosene Sales*, also available at http://www.eia.gov/dnav/pet/pet_cons_821rsd_a_EPPR_VOC_Mgal_a.htm.

RFRRPZZ — Residual fuel oil sold for use by railroads by state.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines,

Mineral Industry Surveys, "Shipments of Fuel Oil and Kerosene." The specific tables are:

- 1960 and 1961: Table 16.
- 1962 and 1963: Table 15.
- 1964 and 1965: Table 14.
- 1966 through 1975: Table 10.
- 1976 through 1978: EIA, *Energy Data Reports*, "Sales of Fuel Oil and Kerosene," Table 10.
- 1979 and 1980: EIA, *Energy Data Reports*, "Deliveries of Fuel Oil and Kerosene," Table 2.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 5.

Note: Data for 1983 forward are published in thousand gallons. They are converted to thousand barrels by dividing by 42 before being entered into SEDS.

- 1983 through 1987: EIA, *Petroleum Marketing Monthly*. The specific tables are:
 - 1983: July 1985 issue, Table A13.
 - 1984 and 1985: July 1986 issue, Table A3.
 - 1986 and 1987: June 1988 issue, Table A5.
- 1988 and 1989: EIA, *Fuel Oil and Kerosene Sales 1989*, Table 5.
- 1990 forward: Series discontinued. Volumes are included with "All Other" data (in SEDS).

RFTCPUS — Residual fuel oil total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Other Petroleum Products

Petroleum coke and 15 petroleum products are summed and called "other petroleum products" in the State Energy Data System (SEDS). These products, in thousand barrels, are:

ABTCPUS	=	aviation gasoline blending components total consumed in the United States;
COTCPZZ	=	crude oil (including lease condensate) total consumed in each state;
FNTCPUS	=	petrochemical feedstocks, naphtha less than 401°F, total consumed in the United States;
FOTCPUS	=	petrochemical feedstocks, other oils equal to or greater than 401°F, total consumed in the United States;
FSTCPUS	=	petrochemical feedstocks, still gas, total consumed in the United States (through 1985);
MBTCPUS	=	motor gasoline blending components total consumed in the United States;
MSTCPUS	=	miscellaneous petroleum products total consumed in the United States;
NATCPUS	=	natural gasoline (including isopentane) total consumed in the United States (through 1983);
PCTCPUS	=	petroleum coke total consumed in the United States;
PLTCPUS	=	plant condensate total consumed in the United States (through 1983);
PPTCPUS	=	pentanes plus total consumed in the United States (from 1984 forward);
SGTCPUS	=	still gas total consumed in the United States;
SNTCPUS	=	special naphthas total consumed in the United States;
UOTCPUS	=	unfinished oils total consumed in the United States;
USTCPUS	=	unfractionated streams total consumed in the United States (through 1983); and
WXTCPUS	=	waxes total consumed in the United States.

The methods used to create state estimates for each of these products (except petroleum coke, which is described earlier in the petroleum coke section beginning on page 62) are explained in the following sections.

It is assumed that all of these products are used by the industrial sector, except for the small portion of petroleum coke consumed by the electric power and commercial sectors. State estimates are created for other petroleum products by using the following six variables to allocate the products to the states:

COCAPZZ	=	atmospheric crude oil distillation operable capacity (operating capacity before 2013) at refineries in each state as of January 1 of the following year, adjusted with information on new, shutdown, and reactivated refineries during the year, in barrels per calendar day;
FNCASZZ	=	state's share of U.S. capacity of steam crackers using naphtha as feedstocks;
FOCASZZ	=	state's share of U.S. capacity of steam crackers using other oils as feedstocks;
OCVAVZZ	=	value of shipments (value added prior to 2001) for the industrial organic chemical manufacturing industry in each state, in million dollars;
PIVAVZZ	=	value of shipments (value added prior to 2001) for the paint and coating manufacturing industry in each state, in million dollars; and
CGVAVZZ	=	value of shipments (value added prior to 2001) for the corrugated and solid fiber box manufacturing industry in each state, in million dollars.

Value of shipments and value added are two measures of manufacturing activity, both from the Department of Commerce *Economic Census* (previously, *Census of Manufactures*) reports. Value of shipments is a close approximation of gross output, adjusted for inventory changes. Value added excludes the cost of materials from gross output. Prior to 2001, value added data were used to allocate the national consumption of selected petroleum products to the states. From 2001 forward, value of shipments data are used instead. The change was made because gross output is considered a better indicator of consumption of fuel and feedstock than value added.

Crude oil

Physical units

State estimates for crude oil consumed in petroleum industry operations are the data series COTCPZZ. The U.S. total for this data series is summed:

$$\text{COTCPUS} = \sum \text{COTCPZZ}$$

Industrial consumption equals total consumption of crude oil:

$$\begin{aligned}\text{COICPZZ} &= \text{COTCPZZ} \\ \text{COICPUS} &= \text{COTCPUS}\end{aligned}$$

British thermal units (Btu)

Crude oil has a heat content value of approximately 5.800 million Btu per barrel. The calculations performed to estimate total Btu consumption and industrial use Btu consumption by state and for the United States are:

$$\begin{aligned}\text{COTCBZZ} &= \text{COTCPZZ} * 5.800 \\ \text{COTCBUS} &= \sum \text{COTCBZZ} \\ \text{COICBZZ} &= \text{COTCBZZ} \\ \text{COICBUS} &= \text{COTCBUS}\end{aligned}$$

Data source

COTCPZZ — Crude oil consumed in petroleum industry operations by state.

- 1960 through 1982: Crude oil used directly was included in distillate and residual fuel oil product supplied when reported to the U. S. Energy Information Administration. Zeros are entered for all years.
- 1983 forward: Data are available for Petroleum Administration for Defense (PAD) districts, not by state. State estimates are calculated by allocating all crude oil consumption to the six states (Alaska, California, Colorado, Louisiana, Texas, and Utah) that reported distillate and residual fuel oils consumed by pipeline and leases in 1982. (Data on pipeline and lease consumption of fuels are not available after 1982.) Each state's 1982 ratio of distillate and residual fuel oils consumed by pipeline and leases to its respective 1982 PAD district total consumption of those fuels is calculated. This ratio is then applied to the 1983 forward PAD district totals of crude oil product supplied. The 1982 ratios are taken from the Form EIA-90, "Crude Oil Stocks Report," and the crude oil product supplied data are taken from the EIA *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>. The specific tables are:
 - 1983 through 1988: Tables 2 and 4 through 8.
 - 1989 through 2004: Tables 2, 4, 6, 8, 10, and 12.
 - 2005 forward: Tables 1, 3, 5, 7, 9, and 11.

Aviation gasoline blending components; petrochemical feedstocks, still gas; motor gasoline blending components; still gas; and unfinished oils

Physical units

The five petroleum products in this category are consumed as refinery fuels.

Beginning in 1986, still gas for petrochemical feedstocks and still gas for other uses are reported together in the source document. State consumption estimates of these products are created in proportion to each state's crude oil operable capacity at refineries (COCAPZZ). Before 2013, operating capacity was used. Occasionally, consumption for aviation gasoline blending components and unfinished oils will be negative. This can occur when such products have entered the primary supply channels with their production not having been reported (e.g., streams returned to refineries from petrochemical plants). The U.S. total for this variable is summed:

$$\text{COCAPUS} = \Sigma \text{COCAPZZ}$$

Aviation gasoline blending components state and U.S. consumption are estimated:

$$\begin{aligned}\text{ABTCPZZ} &= (\text{COCAPZZ} / \text{COCAPUS}) * \text{ABTCPUS} \\ \text{ABICPZZ} &= \text{ABTCPZZ} \\ \text{ABICPUS} &= \text{ABTCPUS}\end{aligned}$$

Petrochemical feedstocks, still gas, state and U.S. consumption are estimated:

$$\begin{aligned}\text{FSTCPZZ} &= (\text{COCAPZZ} / \text{COCAPUS}) * \text{FSTCPUS} \\ \text{FSICPZZ} &= \text{FSTCPZZ} \\ \text{FSICPUS} &= \text{FSTCPUS}\end{aligned}$$

Motor gasoline blending components state and U.S. consumption are estimated:

$$\begin{aligned}\text{MBTCPZZ} &= (\text{COCAPZZ} / \text{COCAPUS}) * \text{MBTCPUS} \\ \text{MBICPZZ} &= \text{MBTCPZZ} \\ \text{MBICPUS} &= \text{MBTCPUS}\end{aligned}$$

Still gas state and U.S. consumption are estimated:

$$\begin{aligned}\text{SGTCPZZ} &= (\text{COCAPZZ} / \text{COCAPUS}) * \text{SGTCPUS} \\ \text{SGICPZZ} &= \text{SGTCPZZ} \\ \text{SGICPUS} &= \text{SGTCPUS}\end{aligned}$$

Unfinished oils state and U.S. consumption are estimated:

$$\begin{aligned}\text{UOTCPZZ} &= (\text{COCAPZZ} / \text{COCAPUS}) * \text{UOTCPUS} \\ \text{UOICPZZ} &= \text{UOTCPZZ} \\ \text{UOICPUS} &= \text{UOTCPUS}\end{aligned}$$

British thermal units (Btu)

Btu estimates for five products in this group are developed by multiplying the estimated consumption of each individual product in physical units by its respective heat content conversion factor. The calculations performed to estimate total Btu consumption and industrial use Btu consumption by state and for the United States are:

$$\begin{aligned}\text{ABTCBZZ} &= \text{ABTCPZZ} * 5.048 \\ \text{ABTCBUS} &= \Sigma \text{ABTCBZZ} \\ \text{ABICBZZ} &= \text{ABTCBZZ} \\ \text{ABICBUS} &= \text{ABTCBUS} \\ \text{FSTCBZZ} &= \text{FSTCPZZ} * 6.000 \\ \text{FSTCBUS} &= \Sigma \text{FSTCBZZ} \\ \text{FSICBZZ} &= \text{FSTCBZZ} \\ \text{FSICBUS} &= \text{FSTCBUS} \\ \text{MBTCBZZ} &= \text{MBTCPZZ} * \text{MBTCKUS} \\ \text{MBTCBUS} &= \Sigma \text{MBTCBZZ} \\ \text{MBICBZZ} &= \text{MBTCBZZ} \\ \text{MBICBUS} &= \text{MBTCBUS} \\ \text{SGTCBZZ} &= \text{SGTCPZZ} * 6.000 \\ \text{SGTCBUS} &= \Sigma \text{SGTCBZZ} \\ \text{SGICBZZ} &= \text{SGTCBZZ} \\ \text{SGICBUS} &= \text{SGTCBUS} \\ \text{UOTCBZZ} &= \text{UOTCPZZ} * 5.825 \\ \text{UOTCBUS} &= \Sigma \text{UOTCBZZ} \\ \text{UOICBZZ} &= \text{UOTCBZZ} \\ \text{UOICBUS} &= \text{UOTCBUS}\end{aligned}$$

The factor for converting motor gasoline blending components from physical unit values to Btu, MBTCKUS, is fixed at 5.253 million Btu per barrel for 1960 through 2006, and at 5.222 million Btu per barrel for 2007 forward:

$$\text{MBTCKUS} = \text{factor for converting motor gasoline blending components from physical units to Btu.}$$

Data sources

ABTCPUS — Aviation gasoline blending components total consumed in the United States.

- 1960 through 1980: No data available. Values are assumed to be zero.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products,

column titled "Products Supplied." The specific tables are:

- 1981 through 2004: Table 2.
- 2005 forward: Table 1.

COCAPZZ — Atmospheric crude oil distillation operable capacity (operating capacity before 2013) at refineries by state as of January 1 of the following year.

- 1960: U.S. Department of the Interior, Bureau of Mines, Petroleum Refineries, Including Cracking Plants, in the United States, Table 3.
- 1961 through 1963: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States." The specific tables are:
 - 1961 and 1962: Table 3.
 - 1963: Table 1.
- 1964 through 1976: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States and Puerto Rico," Table 1.
- 1977: EIA, *Energy Data Reports*, "Petroleum Refineries in the United States and Puerto Rico," Table 1.
- 1978 through 1980: EIA, *Energy Data Reports*, "Petroleum Refineries in the United States and U.S. Territories," Table 1.
- 1981 through 2004: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>. The specific tables are:
 - 1981 through 1983: Table 1.
 - 1984: Table 30.
 - 1985 through 1988: Table 29.
 - 1989 through 1994: Table 36.
 - 1995: Unpublished data based on Form EIA-810.
 - 1996 through 2004: Table 36.
- 2005 forward: EIA, *Refinery Capacity Report*, <http://www.eia.gov/petroleum/refinerycapacity/>, Table 1, supplemented with Table 11 data from 2011 forward.

FSTCPUS — Petrochemical feedstocks, still gas, total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, Petroleum Statement, Annual," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 14.
- 1983 through 1985: EIA, *Petroleum Supply Annual*, Table 12.

- 1986 forward: Included in still gas (SGTCPUS).

MBTCPUS — Motor gasoline blending components total consumed in the United States.

- 1960 through 1980: No data available. Values are assumed to be zero.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

MBTCKUS — Factor for converting motor gasoline blending components from physical units to Btu.

- 1960 through 2006: EIA adopted the Bureau of Mines thermal conversion factor of 5.253 million Btu per barrel, from the Bureau of Mines internal memorandum "Bureau of Mines Standard Average Heating Value of Various Fuels, Adopted January 3, 1950."
- 2007 forward: EIA adopted the thermal conversion factor of 5.222 million Btu per barrel (124,340 Btu per gallon) for gasoline blendstock from U.S. Department of Energy, Argonne National Laboratory, "The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model" (GREET), version GREET1_2013, October 2013.

SGTCPUS — Still gas total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 and 1982: EIA, *Petroleum Supply Annual*, Table 14.
- 1983 through 1985: EIA, *Petroleum Supply Annual*, Table 12.
- 1986 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1986 through 2004: Table 2.
 - 2005 forward: Table 1.

UOTCPUS — Unfinished oils total consumed in the United States.

- 1960 through 1980: No data available. Values assumed to be zero.
- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Petrochemical feedstocks, naphtha less than 401°F; petrochemical feedstocks, other oils equal to or greater than 401°F; natural gasoline (including isopentane); plant condensate; pentanes plus; and unfractionated streams

Physical units

Petrochemical feedstocks, naphtha and other oils, are consumed by the chemical industry in producing petrochemical "building blocks" (such as ethylene) that, in turn, are converted to such products as synthetic fibers, synthetic rubber, and plastics.

Pentanes plus is used mainly as petrochemical feedstocks in the same way as naphtha. Before 2009, pentanes plus product supplied included pentanes plus added to fuel ethanol as denaturant to make it unfit for human consumption. From 2009 forward, this portion is separately reported and is not included in the product supplied.

Natural gasoline (including isopentane), plant condensate, and unfractionated streams are discontinued from the source. Beginning in 1984, natural gasoline and plant condensate are reported together as a new product, pentanes plus; and unfractionated streams is discontinued because its components are reported separately as liquefied petroleum gases. These products are used mostly as petrochemical feedstocks.

The chemical industry produces petrochemicals such as ethylene and propylene by steam cracking. To allocate the U.S. consumption of petrochemical feedstocks to the states, information on nameplate capacity and the share of naphtha and other oils in the feedstock mixture for all steam cracker plants producing ethylene is collected from various issues of the *Oil and Gas Journal* to derive the state shares of capacity of steam crackers using naphtha (FNCASZZ) and those using other oils (FOCASZZ). Based on the data collected for 1997 through 1999, 2002, 2004, 2008, and for 2010 forward, Texas and Louisiana are the only two states that use naphtha and

other oils as feedstocks in their steam crackers. The shares for the interim years are interpolated using the compound annual growth rates of the years with data, and the shares for 1997 are used for the earlier years.

For 2015, information on nameplate capacity and the share of naphthas and other oils in the feedstock mixture for steam cracker plants producing ethylene is not available from the *Oil and Gas Journal*. The 2014 values are used for 2015.

Petrochemical feedstocks, naphtha less than 401°F, state and U.S. consumption are estimated:

$$\begin{aligned}\text{FNTCPZZ} &= \text{FNTCPUS} * \text{FNCASZZ} \\ \text{FNICPZZ} &= \text{FNTCPZZ} \\ \text{FNICPUS} &= \text{FNTCPUS}\end{aligned}$$

Petrochemical feedstocks, other oils equal to or greater than 401°F, state and U.S. consumption are estimated:

$$\begin{aligned}\text{FOTCPZZ} &= \text{FOTCPUS} * \text{FOCASZZ} \\ \text{FOICPZZ} &= \text{FOTCPZZ} \\ \text{FOICPUS} &= \text{FOTCPUS}\end{aligned}$$

Since pentanes plus is mainly used the same way as naphtha feedstock, its state and U.S. consumption are estimated:

$$\begin{aligned}\text{PPTCPZZ} &= \text{PPTCPUS} * \text{FNCASZZ} \\ \text{PPICPZZ} &= \text{PPTCPZZ} \\ \text{PPICPUS} &= \text{PPTCPUS}\end{aligned}$$

Natural gasoline (including isopentane) state and U.S. consumption are estimated:

$$\begin{aligned}\text{NATCPZZ} &= \text{NATCPUS} * \text{FNCASZZ} \\ \text{NAICPZZ} &= \text{NATCPZZ} \\ \text{NAICPUS} &= \text{NATCPUS}\end{aligned}$$

Plant condensate state and U.S. consumption are estimated:

$$\begin{aligned}\text{PLTCPZZ} &= \text{PLTCPUS} * \text{FNCASZZ} \\ \text{PLICPZZ} &= \text{PLTCPZZ} \\ \text{PLICPUS} &= \text{PLTCPUS}\end{aligned}$$

Unfractionated streams state and U.S. consumption are estimated:

$$\text{USTCPZZ} = \text{USTCPUS} * \text{FNCASZZ}$$

USICPZZ = USTCPZZ
USICPUS = USTCPUS

British thermal units (Btu)

Btu estimates for the six petroleum products in this group are developed by multiplying each individual product's estimated consumption in physical units by its respective approximate heat content conversion factor. The calculations performed to estimate total Btu consumption and industrial use Btu consumption by state and for the United States are:

FNTCBZZ = FNTCPZZ * 5.248
FNTCBUS = Σ FNTCBZZ
FNICBZZ = FNTCBZZ
FNICBUS = FNTCBUS
FOTCBZZ = FOTCPZZ * 5.825
FOTCBUS = Σ FOTCBZZ
FOICBZZ = FOTCBZZ
FOICBUS = FOTCBUS
NATCBZZ = NATCPZZ * 4.620
NATCBUS = Σ NATCBZZ
NAICBZZ = NATCBZZ
NAICBUS = NATCBUS
PLTCBZZ = PLTCPZZ * 5.418
PLTCBUS = Σ PLTCBZZ
PLICBZZ = PLTCBZZ
PLICBUS = PLTCBUS
PPTCBZZ = PPTCPZZ * 4.620
PPTCBUS = Σ PPTCBZZ
PPICBZZ = PPTCBZZ
PPICBUS = PPTCBUS
USTCBZZ = USTCPZZ * 5.418
USTCBUS = Σ USTCBZZ
USICBZZ = USTCBZZ
USICBUS = USTCBUS

Additional note

Prior to the 2010 cycle, the six products were allocated to the states in proportion to the value of shipments or value added in the manufacture of industrial organic chemicals from the Economic Censuses collected by the U.S. Census Bureau. Organic chemical manufacturing was used because state-level data for petrochemical manufacturing were not available. This

resulted in the allocation of petrochemical feedstocks to over 25 states, most of which did not produce petrochemicals. The steam cracker capacity shares, while requiring estimations, are better allocators.

Data sources

FNCASZZ — State's share of U.S. capacity of steam crackers using naphtha as feedstocks.

- 1960 through 1996: The share for 1997 is used.
- 1997 through 1999, 2002, 2004, 2008, and 2010 through 2014: *Oil and Gas Journal*, specific issues focusing on ethylene production, table on "International Survey of Ethylene from Steam Crackers."
- 2000, 2001, 2003, 2007, 2009, and 2015: EIA estimation, based on data available from the *Oil and Gas Journal*.

FNTCPUS — Petrochemical feedstocks, naphtha less than 401°F, total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
 - 1981 forward: EIA, *Petroleum Supply Annual*, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

FOCASZZ — State's share of U.S. capacity of steam crackers using other oils as feedstocks.

- 1960 through 1996: The share for 1997 is used.
- 1997 through 1999, 2002, 2004, 2008, and 2010 through 2014: *Oil and Gas Journal*, specific issues focusing on ethylene production, table on "International Survey of Ethylene from Steam Crackers."
- 2000, 2001, 2003, 2007, 2009, and 2015: EIA estimation, based on data available from the *Oil and Gas Journal*.

FOTCPUS — Petrochemical feedstocks, other oils equal to or greater than 401°F, total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Statement, Annual," Table 1.

- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

NATCPUS — Natural gasoline total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys. "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 through 1983: EIA, *Petroleum Supply Annual*, Table 2.
- 1984 forward: Included in pentanes plus (PPTCPUS).

PLTCPUS — Plant condensate total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys. "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 through 1983: EIA, *Petroleum Supply Annual*, Table 2.
- 1984 forward: Included in pentanes plus (PPTCPUS).

PPTCPUS — Pentanes plus total consumed in the United States.

- 1960 through 1983: Data were reported separately as natural gasoline, isopentane, and plant condensate.
- 1984 forward: EIA, *Petroleum Supply Annual*, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1984 through 2004: Table 2.
 - 2005 forward: Table 1.

USTCPUS — Unfractionated streams total consumed in the United States.

- 1960 through 1978: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1, included in "Plant Condensate."
- 1979 and 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 through 1983: EIA, *Petroleum Supply Annual*, Table 2, column titled

"Products Supplied."

- 1984 forward: Included in liquefied petroleum gases (LGTCPUS).

Miscellaneous petroleum products

Physical units

Miscellaneous products include all finished products not classified elsewhere (e.g., petrolatum, lube refining byproducts (aromatic extracts and tars), absorption oils, ram-jet fuel, petroleum rocket fuels, synthetic natural gas feed stocks, and specialty oils). It is assumed that the chief consuming industry for this product line is the organic chemical industry.

State estimates for these products are created in proportion to the value of shipments (value added prior to 2001) in the manufacture of industrial organic chemicals in each state (OCVAVZZ).

The U.S. total for the data series used to apportion these products to the states is summed:

$$\text{OCVAVUS} = \sum \text{OCVAVZZ}$$

Miscellaneous petroleum products state and U.S. consumption are estimated:

$$\begin{aligned} \text{MSTCPZZ} &= (\text{OCVAVZZ} / \text{OCVAVUS}) * \text{MSTCPUS} \\ \text{MSICPZZ} &= \text{MSTCPZZ} \\ \text{MSICPUS} &= \text{MSTCPUS} \end{aligned}$$

British thermal units (Btu)

EIA uses an average heat content value of 5.796 million Btu per barrel for miscellaneous petroleum products. The calculations performed to estimate total Btu consumption and industrial use Btu consumption by state and for the United States are:

$$\begin{aligned} \text{MSTCBZZ} &= \text{MSTCPZZ} * 5.796 \\ \text{MSTCBUS} &= \sum \text{MSTCBZZ} \end{aligned}$$

Miscellaneous petroleum products consumed in the industrial sector is equal to total consumption.

$$\begin{aligned} \text{MSICBZZ} &= \text{MSTCBZZ} \\ \text{MSICBUS} &= \text{MSTCBUS} \end{aligned}$$

Data sources

MSTCPUS — Miscellaneous petroleum products consumed in the United

States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.
- 1981 forward: EIA, *Petroleum Supply Annual*, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1. Naphtha-type jet fuel volumes (JNTCPUS) are included in "Miscellaneous Products" in the *Petroleum Supply Annual*, Table 1.

OCVAVZZ — Value of shipments for the industrial organic chemicals manufacturing industry by state.

Note: Value added prior to 2001.

- 1960 through 1970: U.S. Department of Commerce, *1967 Census of Manufactures*, Volume II, Part 2, Standard Industrial Classification (SIC) 2818. The 1963 state data are used for the years 1960 through 1965, and the 1967 state data are used for 1966 through 1970.
- 1971 through 1980: U.S. Department of Commerce, *1977 Census of Manufactures*, Industry Series, SIC 2869. The 1972 state data are used for 1971 through 1975, and the 1977 state data are used for 1976 through 1980.
- 1981 through 1985: U.S. Department of Commerce, *1987 Census of Manufactures* (Final Report), Industry Series, SIC 2869. The 1982 state data are used for 1981 through 1985.
- 1986 through 1995: U.S. Department of Commerce, *1992 Census of Manufactures* (Final Report), Industry Series, SIC 2869. The 1987 state data are used for 1986 through 1990, and the 1992 state data are used for 1991 through 1995.
- 1996 through 2000: U.S. Department of Commerce, *1997 Economic Census, Manufacturing, Industry Series*, EC97M-3251A for North American Industry Classification System (NAICS) 325110 "Petrochemical Manufacturing" and EC97M-3251G for NAICS 325119 "All Other Basic Inorganic Chemical Manufacturing." The value added by manufacture for both categories are summed to create a data series generally comparable to the SIC 2869 used previously at http://www.census.gov/econ/census/data/historical_data.html.

- 2001 forward: U.S. Department of Commerce, *Economic Census, Manufacturing, Geographic Area Series*, column titled "Value of shipments" data for NAICS series 325110, 325120, and 325199 shown in the datasets at <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. See Additional Note 2 on page 81 for the methodology used to estimate withheld values.
 - 2001 through 2005: 2002 *Economic Census*.
 - 2006 through 2012: 2007 *Economic Census*.
 - 2013 forward: 2012 *Economic Census*

Special naphthas

Physical units

Special naphthas are used as paint and varnish thinners and dry cleaning liquids or solvents. This petroleum product is allocated to the states in proportion to the value of shipments (value added prior to 2001) in the manufacture of paints and allied products in each state (PIVAVZZ).

The U.S. total for the apportioning data series is calculated:

$$\text{PIVAVUS} = \sum \text{PIVAVZZ}$$

Special naphthas state and U.S. consumption are estimated:

$$\begin{aligned}\text{SNTCPZZ} &= (\text{PIVAVZZ} / \text{PIVAVUS}) * \text{SNTCPUS} \\ \text{SNICPZZ} &= \text{SNTCPZZ} \\ \text{SNICPUS} &= \text{SNTCPUS}\end{aligned}$$

British thermal units (Btu)

Special naphthas have a heat content value of approximately 5.248 million Btu per barrel. This factor is applied to convert special naphthas estimated consumption from physical units to Btu by state and the United States is the sum of the states:

$$\begin{aligned}\text{SNTCBZZ} &= \text{SNTCPZZ} * 5.248 \\ \text{SNTCBUS} &= \sum \text{SNTCBZZ}\end{aligned}$$

Special naphthas consumed in the industrial sector is equal to total consumption.

$$\begin{aligned}\text{SNICBZZ} &= \text{SNTCBZZ} \\ \text{SNICBUS} &= \text{SNTCBUS}\end{aligned}$$

Data sources

PIVAVZZ — Value of shipments for the paint and coating manufacturing industry by state.

Note: Value added prior to 2001.

- 1960 through 1970: U.S. Department of Commerce, *1967 Census of Manufactures*, Volume II, Part 2, SIC 2851. The 1963 state data are used for the years 1960 through 1965, and the 1967 state data are used for 1966 through 1970.
- 1971 through 1980: U.S. Department of Commerce, *1977 Census of Manufactures*, Industry Series, SIC 2851. The 1972 state data are used for 1971 through 1975, and the 1977 state data are used for 1976 through 1980.
- 1981 through 1985: U.S. Department of Commerce, *1987 Census of Manufactures* (Final Report), Industry Series, SIC 2851. The 1982 state data are used for the years 1981 through 1985.
- 1986 through 1995: U.S. Department of Commerce, *1992 Census of Manufactures* (Final Report), Industry Series, SIC 2851. The 1987 state data are used for the years 1986 through 1990, and the 1992 state data are used for 1991 through 1995.
- 1996 through 2000: U.S. Department of Commerce, *1997 Economic Census, Manufacturing, Industry Series*, EC97M-3255A for NAICS 325510 "Paint and Coating Manufacturing," at http://www.census.gov/econ/census/data/historical_data.html.
- 2001 forward: U.S. Department of Commerce, *Economic Census, Manufacturing, Geographic Area Series*, column titled "Value of shipments" data for NAICS series 325510 shown in the data sets at <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. See Additional Note 2 on page 81 for the methodology used to estimated withheld values.
 - 2001 through 2005: 2002 *Economic Census*.
 - 2006 through 2012: 2007 *Economic Census*.
 - 2013 forward: 2012 *Economic Census*.

SNTCPUS — Special naphthas total consumed in the United States.

- 1960 through 1963: Data included in motor gasoline.
- 1964 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Petroleum Statement, Annual," Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual," Table 1.

- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled "Products Supplied." The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Waxes

Physical units

Because petroleum waxes are very cost-effective moisture and gas barriers, food packaging is the largest market for petroleum waxes in the United States, accounting for more than 50% of petroleum wax consumption. Therefore, waxes are allocated to the states in proportion to the value of shipments (value added prior to 2001) in the manufacture of corrugated and solid fiber boxes (CGVAVZZ).

The U.S. total for this variable is summed:

$$CGVAVUS = \Sigma CGVAVZZ$$

State and U.S. consumption are estimated:

$$\begin{aligned} WXTCPZZ &= (CGVAVZZ / CGVAVUS) * WXTCPUS \\ WXICPZZ &= WXTCPZZ \\ WXICPUS &= WXTCPUS \end{aligned}$$

British thermal units (Btu)

Waxes have a heat content value of approximately 5.537 million Btu per barrel. This factor is applied to convert the estimated consumption of waxes from physical units to Btu by state and the United States is the sum of the states:

$$\begin{aligned} WXTCBZZ &= WXTCPZZ * 5.537 \\ WXTCBUS &= \Sigma WXTCBZZ \end{aligned}$$

Wax consumption in the industrial sector is equal to total consumption.

$$\begin{aligned} WXICBZZ &= WXTCBZZ \\ WXICBUS &= WXTCBUS \end{aligned}$$

Data sources

CGVAVZZ — Value of shipments for the solid fiber box manufacturing industry by state.

Note: Value added prior to 2001. Prior to 1992, this series was value added for the sanitary food container manufacturing industry.

- 1960 through 1965: U.S. Department of Commerce, *1963 Census of Manufactures*, Volume II, Part 1, SIC 2654. The 1963 state data are used for the years 1960 through 1965.
- 1966 through 1970: U.S. Department of Commerce, *1967 Census of Manufactures*, Volume II, Part 2, SIC 2654. The 1967 state data are used for 1966 through 1970.
- 1971 through 1980: U.S. Department of Commerce, *1977 Census of Manufactures*, Industry Series, SIC 2654. The 1972 state data are used for 1971 through 1975, and the 1977 state data are used for 1976 through 1980.
- 1981 through 1990: U.S. Department of Commerce, *1982 Census of Manufactures* (Final Report), Industry Series, SIC 2654. The 1982 state data are used for 1981 through 1990.
- 1991 through 1995: U.S. Department of Commerce, *1992 Census of Manufactures* (Final Report), Industry Series, SIC 2653. The 1992 state data are used for 1991 through 1995.
- 1996 through 2000: U.S. Department of Commerce, *1997 Economic Census, Manufacturing, Industry Series*, EC97M-3222A for NAICS 322211 “Corrugated and Solid Fiber Box Manufacturing” at http://www.census.gov/econ/census/data/historical_data.html.
- 2001 forward: U.S. Department of Commerce, *Economic Census, Manufacturing, Geographic Area Series*, column titled “Value of shipments” data for NAICS series 322211 shown in the data sets at <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. See Additional Note 2 on page 81 for the methodology used to estimated withheld values.
 - 2001 through 2005: 2002 *Economic Census*.
 - 2006 through 2012: 2007 *Economic Census*.
 - 2013 forward: 2012 *Economic Census*

WXTCPUS — Waxes total consumed in the United States.

- 1960 through 1975: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, “Petroleum Statement, Annual,” Table 1.
- 1976 through 1980: EIA, *Energy Data Reports*, “Petroleum Statement, Annual,” Table 1.

- 1981 forward: EIA, *Petroleum Supply Annual*, <http://www.eia.gov/petroleum/supply/annual/volume1/>, table on U.S. Supply, Disposition, and Ending Stocks of Crude Oil and Petroleum Products, column titled “Products Supplied.” The specific tables are:
 - 1981 through 2004: Table 2.
 - 2005 forward: Table 1.

Total other petroleum products

Physical units

Total other petroleum products is the sum of the 16 “other petroleum products.” All of these products are consumed by the industrial sector except for some petroleum coke consumed by the electric power sector (PCEIP), which is calculated in SEDS with electric power fuel consumption, and the commercial sector (PCCCP), which is included with commercial consumption. State and U.S. industrial use of these other petroleum products are calculated:

$$\begin{aligned} \text{POICPZZ} &= \text{ABICPZZ} + \text{COICPZZ} + \text{FNICPZZ} + \text{FOICPZZ} + \\ &\quad \text{FSICPZZ} + \text{MBICPZZ} + \text{MSICPZZ} + \text{NAICPZZ} + \\ &\quad \text{PCICPZZ} + \text{PLICPZZ} + \text{PPICPZZ} + \text{SGICPZZ} + \\ &\quad \text{SNICPZZ} + \text{UOICPZZ} + \text{USICPZZ} + \text{WXICPZZ} \\ \text{POICPUS} &= \Sigma \text{POICPZZ} \end{aligned}$$

Total consumption of these products (including petroleum coke consumption in the commercial and electric power sectors) is calculated:

$$\begin{aligned} \text{POTCPZZ} &= \text{ABTCPZZ} + \text{COTCPZZ} + \text{FNTCPZZ} + \text{FOTCPZZ} + \\ &\quad \text{FSTCPZZ} + \text{MBTCPZZ} + \text{MSTCPZZ} + \text{NATCPZZ} + \\ &\quad \text{PCTCPZZ} + \text{PLTCPZZ} + \text{PPTCPZZ} + \text{SGTCPZZ} + \\ &\quad \text{SNTCPZZ} + \text{UOTCPZZ} + \text{USTCPZZ} + \text{WXTCPZZ} \\ \text{POTCPUS} &= \Sigma \text{POTCPZZ} \end{aligned}$$

British thermal units (Btu)

Estimated consumption of all 16 “other petroleum products” in Btu is the sum of the Btu consumption of each product by the industrial sector. The state and U.S. totals are calculated:

$$\begin{aligned} \text{POICBZZ} &= \text{ABICBZZ} + \text{COICBZZ} + \text{FNICBZZ} + \text{FOICBZZ} + \\ &\quad \text{FSICBZZ} + \text{MBICBZZ} + \text{MSICBZZ} + \text{NAICBZZ} + \\ &\quad \text{PCICBZZ} + \text{PLICBZZ} + \text{PPICBZZ} + \text{SGICBZZ} + \\ &\quad \text{SNICBZZ} + \text{UOICBZZ} + \text{USICBZZ} + \text{WXICBZZ} \end{aligned}$$

$$\text{POICBUS} = \Sigma \text{POICBZZ}$$

State and U.S. total consumption of these products, which includes petroleum coke consumption in the commercial and electric power sectors, is calculated:

$$\begin{aligned} \text{POTCBZZ} &= \text{ABTCBZZ} + \text{COTCBZZ} + \text{FNTCBZZ} + \text{FOTCBZZ} + \\ &\quad \text{FSTCBZZ} + \text{MBTCBZZ} + \text{MSTCBZZ} + \text{NATCBZZ} + \\ &\quad \text{PCTCBZZ} + \text{PLTCBZZ} + \text{PPTCBZZ} + \text{SGTCBZZ} + \\ &\quad \text{SNTCBZZ} + \text{UOTCBZZ} + \text{USTCBZZ} + \text{WXTCBZZ} \\ \text{POTCBUS} &= \Sigma \text{POTCBZZ} \end{aligned}$$

Additional notes

1. The data for “value added” and “value of shipments” that are used to allocate some of the other petroleum products are from the U.S. Department of Commerce, Census Bureau, *Census of Manufactures* or *Economic Census* reports. For all years, several states’ data were withheld from publication to avoid disclosing operations of individual companies. The total withheld data was apportioned to the withheld states on the basis of those states’ proportional values in the previous census. In the 1992 *Census of Manufactures*, the total withheld value was apportioned to states with withheld data in proportion to the number of employees in that industry in each state. Beginning with the 1997 *Economic Census*, the published report tables do not list any states that have withheld data. Detailed data tables from “American FactFinder” on the U.S. Census Bureau website, <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>, are used to obtain the list of states with data withheld and the number of employees.
2. In 1982, all respondents to the *Census of Manufactures* survey were requested to report their inventories at cost or market prior to accounting adjustments for “last in, first out” cost. This is a change from prior years in which respondents were permitted to value their inventories by using any generally accepted accounting valuation method. Consequently, data for value added by manufacture after 1982 are not comparable to the prior years’ data.

Petroleum Aggregates

This section describes the method of estimating consumption by the major end-use sectors within the states for all petroleum data series. Table TN4.1 on page 30 of this section indicates which petroleum products are consumed in each of the five major end-use sectors. In the preceding portions of this section, end-use consumption estimates have been derived for each petroleum product. These petroleum product subtotals are now summed, in physical units of thousand barrels and in Btu, to create estimated end-use consumption for all petroleum products.

Residential sector

Petroleum products consumed by the residential sector are: distillate fuel oil (DF); kerosene (KS); and liquefied petroleum gases (LG). For the residential sector, the state and U.S. totals in physical units are:

$$\begin{aligned} \text{PARCPZZ} &= \text{DFRCPZZ} + \text{KSRCPPZZ} + \text{LGRCPZZ} \\ \text{PARCPUS} &= \Sigma \text{PARCPZZ} \end{aligned}$$

State and U.S. totals in Btu are:

$$\begin{aligned} \text{PARCBZZ} &= \text{DFRCBZZ} + \text{KSRCBZZ} + \text{LGRCBZZ} \\ \text{PARCBUS} &= \Sigma \text{PARCBZZ} \end{aligned}$$

Commercial sector

The commercial sector’s use of petroleum products includes: distillate fuel oil (DF); kerosene (KS); liquefied petroleum gases (LG); motor gasoline (MG); and residual fuel oil (RF). In physical units, the state and the U.S. totals for the commercial sector are calculated:

$$\begin{aligned} \text{PACCPZZ} &= \text{DFCCPZZ} + \text{KSCCPZZ} + \text{LGCCPZZ} + \text{MGCCPZZ} + \\ &\quad \text{RFCCPZZ} + \text{PCCCPZZ} \\ \text{PACCPUS} &= \Sigma \text{PACCPZZ} \end{aligned}$$

State and U.S. totals in Btu are:

$$\begin{aligned} \text{PACCBZZ} &= \text{DFCCBZZ} + \text{KSCCBZZ} + \text{LGCCBZZ} + \text{MGCCBZZ} + \\ &\quad \text{RFCCBZZ} + \text{PCCCBZZ} \\ \text{PACCBUS} &= \Sigma \text{PACCBZZ} \end{aligned}$$

Industrial sector

Petroleum used in the industrial sector includes: asphalt and road oil (AR); distillate fuel oil (DF); kerosene (KS); liquefied petroleum gases (LG); lubricants (LU); motor gasoline (MG); residual fuel oil (RF); and the 16 products that are already summed in the “other petroleum products” (PO) subtotal. The state and U.S. total estimates in physical units are:

$$\begin{aligned} \text{PAICPZZ} &= \text{ARICPZZ} + \text{DFICPZZ} + \text{KSICPZZ} + \text{LGICPZZ} + \text{LUICPZZ} + \\ &\quad \text{MGICPZZ} + \text{RFICPZZ} + \text{POICPZZ} \\ \text{PAICPUS} &= \Sigma \text{PAICPZZ} \end{aligned}$$

State and U.S. totals in Btu are:

$$\begin{aligned} \text{PAICBZZ} &= \text{ARICBZZ} + \text{DFICBZZ} + \text{KSICBZZ} + \text{LGICBZZ} + \\ &\quad \text{LUICBZZ} + \text{MGICBZZ} + \text{RFICBZZ} + \text{POICBZZ} \\ \text{PAICBUS} &= \Sigma \text{PAICBZZ} \end{aligned}$$

Transportation sector

Petroleum products used in the transportation sector are: aviation gasoline (AV); distillate fuel oil (DF); jet fuel (JF); liquefied petroleum gases (LG); lubricants (LU); motor gasoline (MG); and residual fuel oil (RF). The state and U.S. totals in physical units are:

$$\begin{aligned} \text{PAACPZZ} &= \text{AVACPZZ} + \text{DFACPZZ} + \text{JFACPZZ} + \text{LGACPZZ} + \\ &\quad \text{LUACPZZ} + \text{MGACPZZ} + \text{RFACPZZ} \\ \text{PAACPUS} &= \Sigma \text{PAACPZZ} \end{aligned}$$

State and U.S. totals in Btu are:

$$\begin{aligned} \text{PAACBZZ} &= \text{AVACBZZ} + \text{DFACBZZ} + \text{JFACBZZ} + \text{LGACBZZ} + \\ &\quad \text{LUACBZZ} + \text{MGACBZZ} + \text{RFACBZZ} \\ \text{PAACBUS} &= \Sigma \text{PAACBZZ} \end{aligned}$$

Electric power sector

Petroleum products consumed by the electric power sector are: distillate fuel oil (DF), jet fuel (JF), petroleum coke (PC), and residual fuel oil (RF). In physical units, the state and U.S. totals are:

$$\begin{aligned} \text{PAEIPZZ} &= \text{DFEIPZZ} + \text{JFEUPZZ} + \text{PCEIPZZ} + \text{RFEIPZZ} \\ \text{PAEIPUS} &= \Sigma \text{PAEIPZZ} \end{aligned}$$

State and U.S. totals in Btu are:

$$\begin{aligned} \text{PAEIBZZ} &= \text{DFEIBZZ} + \text{JFEUBZZ} + \text{PCEIBZZ} + \text{RFEIBZZ} \\ \text{PAEIBUS} &= \Sigma \text{PAEIBZZ} \end{aligned}$$

Total consumption of petroleum products

Total consumption of all petroleum products is the sum of all of the individual product totals. The state and U.S. physical unit totals are:

$$\begin{aligned} \text{PATCPZZ} &= \text{ARTCPZZ} + \text{AVTCPZZ} + \text{DFTCPZZ} + \text{JFTCPZZ} + \\ &\quad \text{KSTCPZZ} + \text{LGTCPZZ} + \text{LUTCPZZ} + \text{MGTCPZZ} + \\ &\quad \text{RFTCPZZ} + \text{POTCPZZ} \\ \text{PATCPUS} &= \Sigma \text{PATCPZZ} \end{aligned}$$

State and U.S. totals in Btu are:

$$\begin{aligned} \text{PATCBZZ} &= \text{ARTCBZZ} + \text{AVTCBZZ} + \text{DFTCBZZ} + \text{JFTCBZZ} + \\ &\quad \text{KSTCBZZ} + \text{LGTCBZZ} + \text{LUTCBZZ} + \text{MGTCBZZ} + \\ &\quad \text{RFTCBZZ} + \text{POTCBZZ} \\ \text{PATCBUS} &= \Sigma \text{PATCBZZ} \end{aligned}$$

Additional calculations

A few petroleum products are combined for display in the “Other Petroleum” column in tables on total energy consumption and industrial sector energy consumption. They include asphalt and road oil, aviation gasoline (total energy only), kerosene, lubricants, and the 16 petroleum products described in the “other petroleum products” section of the Technical Notes. The variables are calculated in physical unit and Btu, for each state and the United States:

$$\begin{aligned} \text{P1TCP} &= \text{ARTCP} + \text{AVTCP} + \text{KSTCP} + \text{LUTCP} + \text{POTCP} \\ \text{P1TCB} &= \text{ARTCB} + \text{AVTCB} + \text{KSTCB} + \text{LUTCB} + \text{POTCB} \\ \text{P1ICP} &= \text{ARICP} + \text{KSICP} + \text{LUICP} + \text{POICP} \\ \text{P1ICB} &= \text{ARICB} + \text{KSICB} + \text{LUICB} + \text{POICB} \end{aligned}$$

Total petroleum typically reflects motor gasoline including fuel ethanol. To assist data users in the analysis of consumption of renewable energy sources, which include fuel ethanol, versus non-renewable energy sources, which include petroleum products and other fossil fuels, a new data series, total petroleum excluding fuel ethanol, is created for each state and the United States:

From 1993 forward:

$$\text{PMTCB} = \text{PATCB} - \text{EMTCB}$$

Prior to 1993, fuel ethanol was not included in the motor gasoline data series from the source:

$$\text{PMTCB} = \text{PATCB}$$

Total petroleum excluding fuel ethanol is used only in the tables showing energy consumption by source. For consumption by end-use sector, total petroleum includes fuel ethanol, as it is included in motor gasoline as it is consumed by the end-users.

Conversion factors for all petroleum products consumed by each sector, as well as data for the residential and commercial sectors combined, are calculated for use in EIA's *Annual Energy Review* and *Monthly Energy Review*.

$$\begin{aligned}\text{PARCKUS} &= \text{PARCBUS} / \text{PARCPUS} \\ \text{PACCKUS} &= \text{PACCBUS} / \text{PACCPUS} \\ \text{PAICKUS} &= \text{PAICBUS} / \text{PAICPUS} \\ \text{PAACKUS} &= \text{PAACBUS} / \text{PAACPUS} \\ \text{PAEIKUS} &= \text{PAEIBUS} / \text{PAEIPUS} \\ \text{PATCKUS} &= \text{PATCBUS} / \text{PATCPUS}\end{aligned}$$

Consumption of all petroleum products by the residential and commercial sectors combined, in physical units, in Btu, and the average conversion factor, are calculated:

$$\begin{aligned}\text{PAHCPUS} &= \text{PARCPUS} + \text{PACCPUS} \\ \text{PAHCBUS} &= \text{PARCBUS} + \text{PACCBUS} \\ \text{PAHCKUS} &= \text{PAHCBUS} / \text{PAHCPUS}\end{aligned}$$