

Section 4. Petroleum

Petroleum Overview

The State Energy Data System (SEDS) estimates petroleum product consumption by state for many different individual products. At the national level, SEDS assumes consumption of each petroleum product is equal to the U.S. Energy Information Administration's (EIA) U.S. "product supplied" data series. 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, EIA calculates product supplied of each product 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.

No source data on state-level product supplied by sector are available, so SEDS estimates them. The following subsections describe the sources and methods for estimating petroleum product consumption by state and sector.

SEDS describes the estimation methods for 10 of these products in individual sections:

- asphalt and road oil
- aviation gasoline
- distillate fuel oil
- hydrocarbon gas liquids
- jet fuel
- kerosene
- lubricants
- motor gasoline
- petroleum coke
- residual fuel oil

SEDS describes the remaining products in the section "Other Petroleum Products" and include the following:

- crude oil, including lease condensate
- miscellaneous petroleum products
- petrochemical feedstocks, naphtha less than 401°F
- petrochemical feedstocks, other oils equal to or greater than 401°F

- petrochemical feedstocks, still gas
- special naphthas
- still gas
- waxes
- unfinished oils
- motor gasoline blending components
- aviation gasoline blending components

The last petroleum documentation section, "Petroleum Summaries," describes how SEDS combines the petroleum products for each major end-use sector's estimated consumption.

Additional notes

1. SEDS assumes U.S. consumption of each petroleum product equals its total product supplied. Occasionally, product supplied for some petroleum products can have negative values (see Energy Information Administration (EIA) *Petroleum Supply Annual* Explanatory Notes, <http://www.eia.gov/petroleum/supply/monthly/pdf/psmnotes.pdf>). No attempt is made to adjust for negative product supplied values in SEDS.
2. Beginning in the 2016 SEDS data cycle, "hydrocarbon gas liquids" (which covers normal butane, butylene, ethane, ethylene, isobutane, isobutylene, natural gasoline (pentanes plus), propane, and propylene) replaces "liquefied petroleum gases" (which includes all hydrocarbon gas liquids except natural gasoline) as a petroleum product. The definition of "other petroleum products" is revised to exclude petroleum coke and natural gasoline (formerly pentanes plus). Petroleum coke is reported as a separate product and natural gasoline is included in hydrocarbon gas liquids.

Table TN4.1 summarizes the petroleum products' sector assignments in SEDS. Shown in this table are the first four letters of the SEDS variable names. The first two letters identify the petroleum product and the next two letters identify the energy-consuming 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

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
	+		+		+		+	+		+	
Hydrocarbon gas liquids (HL)	HLRC	+	HLCC	+	HLIC	+	HLAC		=	HLTC	
	+		+		+		+			+	
Jet fuel (JF)							JFAC	+	JFEU	=	JFTC
							+	+		+	
Kerosene (KS)	KSRC	+	KSCC	+	KSIC				=	KSTC	
			+		+					+	
Lubricants (LU)					LUIC	+	LUAC		=	LUTC	
					+		+			+	
Motor gasoline (MG)			MGCC	+	MGIC	+	MGAC		=	MGTC	
			+		+		+			+	
Residual fuel oil (RF)			RFCC	+	RFIC	+	RFAC	+	RFEI	=	RFTC
			+		+			+		+	
Petroleum coke (PC)			PCCC	+	PCIC	+			PCEI	=	PCTC
					+					+	
Other petroleum products (OP)					OPIC				=	OPTC	
Total petroleum (PA)	PARC	+	PACC	+	PAIC	+	PAAC	+	PAEI	=	PATC

of lubricants in the industrial and transportation sectors, while distillate fuel oil is consumed in every sector.

Asphalt and Road Oil

Physical units

The State Energy Data System (SEDS) estimates asphalt and road oil consumption by state for the industrial sector only. SEDS assigns all consumption of asphalt and road oil to the industrial sector because they are mostly used in construction activity, which is in the industrial sector. However, there are no state-level consumption source data available for asphalt and road oil. To estimate state-level asphalt and road oil consumption, SEDS uses other asphalt data series to allocate total U.S. consumption to the states. Before 2009, SEDS uses state-level sales data as state allocators. For 2009 forward, SEDS uses state-level production of hot-mix asphalt and warm-mix asphalt, excluding reclaimed asphalt pavement, as allocators.

The state-level asphalt and road oil sales and production data are in short tons, while the U.S.-level consumption data are in thousand barrels. SEDS only uses the tonnage data to allocate the U.S. consumption to the states so the data do not need to be converted into thousand barrels.

SEDS uses five data series to estimate consumption of asphalt and road oil (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 consumption 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 (through 1982); and
RDTCPUS	=	road oil total consumption in the United States, in thousand barrels (through 1982).

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 U.S. Energy Information Administration’s (EIA) *Petroleum Supply Annual*. For 1983 forward, asphalt product supplied includes road oil, and SEDS assigns RDTCPUS a value of zero.

Before 2009, SEDS used state-level asphalt sales data 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 from various sources depending on the year, and are: the Department of Interior (1960–1977), EIA (1978–1980), and the Asphalt Institute (1981–2008). SEDS estimates RDINPZZ for 1981 and 1982 as described under “Additional Notes” in this section. For 1983 forward, when the source includes road oil in asphalt product supplied data, SEDS assigns RDINPZZ a value of zero.

To calculate state consumption estimates of asphalt, SEDS sums total sales of asphalt and road oil in the United States to the industrial sector 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:

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

For 2009 forward, the Asphalt Institute no longer provides state-level asphalt sales data. To estimate state-level consumption, SEDS uses state-level production of hot-mix asphalt and warm-mix asphalt (HMA/WMA) excluding reclaimed asphalt pavement (RAP), ASPRPZZ, to allocate U.S. consumption to the states. The National Asphalt Pavement Association (NAPA) collects these data. The paving industry uses HMA/WMA, which contains about 5% asphalt binder (the petroleum product measured in SEDS). The use of recycled materials reduces the need of asphalt binder. So, SEDS removes RAP tonnage from HMA/WMA tonnage to estimate the state allocators. While estimates of HMA/WMA tonnage are available from the source for all states, the source withholds RAP estimates for some states. SEDS estimates the withheld states.

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

SEDS calculates each state’s consumption of asphalt in the industrial sector (ASICPZZ) to be proportional to each state’s HMA/WMA production:

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

Because SEDS assumes the industrial sector uses all asphalt and road oil, total consumption in each state equals the industrial sector consumption:

ASTCPZZ = ASICPZZ
 RDTCPZZ = RDICPZZ

SEDS sums asphalt and road oil consumption:

ARICPZZ = ASICPZZ + RDICPZZ
 ARICPUS = ΣARICPZZ
 ARTCPZZ = ASTCPZZ + RDTCPZZ
 ARTCPUS = ΣARTCPZZ

British thermal units (Btu)

EIA assumes asphalt and road oil have a heat content value of 6.636 million Btu per barrel. SEDS uses this factor to convert estimated asphalt and road oil consumption from physical units to Btu:

ARICBZZ = ARICPZZ * 6.636
 ARICBUS = ΣARICBZZ

Because SEDS assumes the industrial sector uses all asphalt and road oil, total consumption in each state and in the United States is assumed to equal the industrial sector consumption:

ARTCBZZ = ARICBZZ
 ARTCBUS = ARICBUS

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. Before 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.*

For 2009 forward, production data from NAPA are used as state allocators.

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: National Asphalt Pavement Association, *Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt*

Usage, <https://www.asphaltpavement.org/expertise/sustainability/sustainability-resources/recycling>.

ASTCPUS — Asphalt total consumption 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 (through 1982).

- 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.)

RDTCPUS — Road oil total consumption in the United States (through 1982).

- 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.

Aviation Gasoline

Physical units

For 1960 to 2014, three data series are used to estimate consumption of aviation gasoline:

- 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 consumption 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:

$$\begin{aligned} \text{AVMIPUS} &= \sum \text{AVMIPZZ} \\ \text{AVNMMUS} &= \sum \text{AVNMMZZ} \end{aligned}$$

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

$$\text{AVNMPZZ} = \text{AVNMMZZ} / 42$$

The U.S. nonmilitary sales is the sum of the states’ sales:

$$\text{AVNMPUS} = \sum \text{AVNMPZZ}$$

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

$$\begin{aligned} \text{AVTTPZZ} &= \text{AVNMPZZ} + \text{AVMIPZZ} \\ \text{AVTTPUS} &= \sum \text{AVTTPZZ} \end{aligned}$$

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:

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

For 2015 forward, SEDS uses a new method to estimate aviation gasoline consumption. EIA publishes annual prime supplier sales volumes of aviation gasoline by state, which include sales to military users, in *Petroleum Marketing Monthly* and on the EIA website. For all states except Alaska and Hawaii, withheld volumes are estimated in SEDS using previous years' data.

For Hawaii, unpublished estimates of aviation gasoline fuel used for aircraft operating primarily in Hawaii from the Federal Aviation Administration's *General Aviation and Part 135 Activity Survey* are used to approximate prime supplier sales.

For Alaska, the estimated prime supplier sales volume is very small because most of Alaska's aviation gasoline is provided by California. Instead of using prime supplier sales, reported taxable volume of aviation gasoline from the Alaska Department of Revenue, Tax Division's *Motor Fuel Tax Annual Report*, calculated on a calendar year basis, is used to approximate aviation gasoline sales in Alaska.

To account for the volume of aviation gasoline shipped to Alaska, California's prime supplier sales volume is redefined as the difference between total sales volumes of Petroleum Administration for Defense District (PADD) 5 and the sum of sales volumes of all other PADD5 states.

$$\text{AVTTMZZ} = \text{aviation gasoline sold to all users in each state, in thousand gallons; and}$$

Aviation gasoline sales in thousand barrels, AVTTPZZ, are calculated and their shares are applied to total U.S. consumption (AVTCPUS) to estimate aviation gasoline consumption by state in the same way as prior years:

$$\begin{aligned} \text{AVTTPZZ} &= \text{AVTTMZZ} / 42 \\ \text{AVTTPUS} &= \Sigma \text{AVTTPZZ} \end{aligned}$$

$$\text{AVACPZZ} = (\text{AVTTPZZ} / \text{AVTTPUS}) * \text{AVTCPUS}$$

$$\text{AVACPUS} = \Sigma \text{AVACPZZ}$$

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

British thermal units (Btu)

Aviation gasoline has a heat content value of about 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:

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

Data sources

AVMIPZZ — Aviation fuel issued to the military in the United States by state (through 2014).

- 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 through 2014: 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 (through 2014).

- 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 (1965), Table MF-24 (1966 through 2006), and Table 8.4.3 (2007 forward).

AVTCPUS — Aviation gasoline total consumption 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.

AVTTMZZ — Aviation gasoline sold to all users by state (2015 forward).

- 2015 forward:
 - EIA, *Petroleum Marketing Monthly*, also available at https://www.eia.gov/dnav/pet/pet_cons_prim_a_EPPV_POO_Mgalpd_a.htm.
 - For Alaska, unpublished monthly data from the Alaska Department of Revenue, Tax Division.
 - For Hawaii, unpublished data from the Federal Aviation Administration, *General Aviation and Part 135 Activity Survey*.

Distillate Fuel Oil

Physical units

The State Energy Data System (SEDS) uses sales of distillate fuel oil into or within each state, published in the U.S. Energy Information Administration's (EIA) *Fuel Oil and Kerosene Sales Report*, to estimate distillate fuel oil consumption. SEDS assigns the following variable names 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.

SEDS uses three additional data series to calculate 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 (through 1982); and
- DFTCPUS = distillate fuel oil total consumption in the United States, in thousand barrels.

EIA collects distillate fuel oil consumption in the electric power sector on Form EIA-923, "Power Plant Operations Report," and predecessor forms. Before 2001, the data series DKEIPZZ includes kerosene-type jet fuel consumed at electric utilities that is identified as JKEUPZZ. SEDS subtracts the kerosene-type jet fuel data from the distillate fuel oil data to avoid double counting. The kerosene-type jet fuel data are included in the SEDS jet fuel data. The source provides electric utility kerosene-type jet fuel consumption data for 1972 through 1982 only. SEDS assumes that consumption in all other years is zero. For 2001 forward, DKEIPZZ no longer contains kerosene-type jet fuel. SEDS continues to use DKEIPZZ to represent distillate fuel oil consumed by the electric power sector. (See Note 4 at the end of this distillate fuel oil section for further information on changes in this series' data definitions.)

Total consumption of distillate fuel oil in the United States, DFTCPUS, is the product supplied series in EIA's *Petroleum Supply Annual*. For 2011 forward, product supplied of distillate fuel oil includes all biofuels blended into distillate fuel oil. Before 2011, product supplied of distillate fuel oil only includes the portion of biofuels that was reported as refinery and blender net input.

First, SEDS calculates the U.S. totals of the state-level data series listed above as the sums of the state data.

Next, SEDS assigns the data series to the four end-use sectors used in SEDS. The residential sector sales and the commercial sector sales contain only DFRSPZZ and DFCMPZZ, respectively.

SEDS calculates each state's total distillate fuel oil sales to the industrial sector (DFINPZZ) as the sum of the data series for industrial heating and farm use (DFIBPZZ), oil company use (DFOCPZZ), off-highway use (DFOFPZZ), and all other uses (DFOTPZZ):

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

SEDS calculates each state's total distillate fuel oil sales to the transportation sector (DFTRPZZ) as the sum of the data series for vessel bunkering (DFBKPZZ), military use (DFMIPZZ), railroad use (DFRRPZZ), and the diesel fuel used on-highway (DFONPZZ):

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

SEDS sums the sales of distillate fuel oil to the residential, commercial, industrial, and transportation sectors to create a subtotal of sales to all end-use sectors, DFNDPZZ:

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

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

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

For 2001 forward, SEDS assumes consumption of distillate fuel oil in the electric power sector (DFEIPZZ) is the same as DKEIPZZ:

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

For all years, SEDS calculates the U.S. total as the sum of the states:

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

SEDS calculates the U.S. distillate fuel oil consumption by all end-use sectors, DFNCPUS, by subtracting the distillate fuel oil consumption by the electric power sector from the total U.S. distillate fuel oil consumption:

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

SEDS allocates the U.S. subtotal of distillate fuel oil consumption by the four end-use sectors, DFNCPUS, to the states by use of the end-use sectors' state level sales data. SEDS assumes 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 divided into estimates for the four end-use sectors in proportion to each sector's sales. SEDS calculates residential sector consumption in each state, DFRCPZZ, as:

$$\text{DFRCPZZ} = (\text{DFRSPZZ} / \text{DFNDPZZ}) * \text{DFNCPZZ}$$

$$\text{DFRCPU} = \sum \text{DFRCPPZ}$$

SEDS calculates the commercial sector's estimated consumption in each state, DFCCPZZ, as:

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

SEDS calculates the industrial sector's estimated consumption in each state, DFICPZZ, as:

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

SEDS calculates the transportation sector's estimated consumption in each state, DFACPZZ, as:

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

SEDS estimates total state distillate fuel oil consumption as the sum of all end-use sectors consumption and electric power sector consumption:

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

British thermal units (Btu)

For 1994 forward, EIA calculates the annual U.S. distillate fuel oil Btu conversion factor, DFTCKUS, as a consumption-weighted average of the heat contents of three categories of distillate fuel oil by sulfur content. DFTCKUS is shown in Table B1 on page 185. For 1960 through 1993, SEDS uses a constant factor of 5.825 million Btu per barrel:

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

SEDS applies this factor to convert estimated distillate fuel oil consumption for the five consuming sectors from physical units to Btu. For example, in the residential sector:

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

SEDS calculates total Btu consumption of distillate fuel oil as the sum of the consumption by the four end-use sectors and the electric power sector:

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

SEDS calculates the U.S. Btu consumption estimates as the sum of all the states.

In the SEDS consumption tables, "Electric Power Sector Consumption Estimates," the data used in the column headed "Distillate Fuel Oil" is the variable DKEIP, which includes kerosene-type jet fuel before 2001, in physical units. The Btu variable, DKEIB, is calculated as follows (See page 59 for description of JKEUB):

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

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.

Additional calculations

To assist data users in the analysis of consumption of fossil fuel sources and renewable energy sources, a data series, distillate fuel oil excluding biodiesel, is created for each state and the United States:

From 2009 forward:

$$\text{DMTCB} = \text{DFTCB} - \text{BDTCB}$$

Before 2009, SEDS assumes that biodiesel was not included in distillate fuel oil total consumption:

$$\text{DMTCB} = \text{DFTCB}$$

See discussion on biodiesel in Section 5, "Renewable Energy."

Distillate fuel oil excluding biodiesel is used only in the tables showing primary energy consumption by source. For consumption by end-use sector, distillate fuel oil is defined as the product consumed by the end users, that is, including biodiesel.

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.

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 https://www.eia.gov/dnav/pet/pet_cons_821dst_a_EPDO_vin_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.

DFOFPZZ — 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_EP2D_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_EP2D_VHF_Mgal_a.htm.

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.

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- 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 biofuels 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 185.

DFTCPUS — Distillate fuel oil total consumption 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 (through 1982). (See data sources for JKEUPZZ under “Jet Fuel” on page 59.)

Hydrocarbon Gas Liquids (1960–2009)

Hydrocarbon gas liquids (HGL) cover natural gas liquids (ethane, propane, normal butane, isobutane, and natural gasoline) and refinery olefins (ethylene, propylene, butylene, and isobutylene). Refinery olefins are olefins produced at refineries and do not include olefins produced by the manufacturing industries. The State Energy Data System (SEDS) assumes that, except for propane, all other HGL products are consumed only by the industrial sector.

Historically, SEDS produced consumption estimates for liquefied petroleum gases (LPG), which included ethane/ethylene, isobutane/isobutylene, normal butane/butylene, propane/propylene, butane-propane mixtures, and ethane-propane mixtures. Pentanes plus (natural gasoline) and three other former products (natural gasoline, plant condensate, and unfractionated streams) were covered in “other petroleum products.”

In mid-2010s, the U.S. Energy Information Administration (EIA) began using hydrocarbon gas liquids to describe the nine products and separated the refinery olefins from the natural gas liquids in its product supplied data for 2010 forward. SEDS adopted the HGL definition and applied new estimation methodologies for the individual HGL products for 2010 forward (see page 52). For 1960 through 2009, SEDS assumes HGL consumption to be the sum of LPG and pentanes plus (natural gasoline) consumption. The term “LPG” is no longer used after 2009.

Liquefied petroleum gases (LPG)

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

LGTPPZZ = 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 consumption in the United States, in thousand barrels (through 2009).

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 (through 2009).

Its computation is described in detail in Note 2 on page 45.

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

- LGRCSSZ = the residential sector share of LPG residential and commercial sales (through 2009); and
- LGCCSSZ = the commercial sector share of LPG residential and commercial sales (through 2009).

Their computation is described in detail in Note 3 on page 45.

Because 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 = ΣLGCBPZZ
- LGHCPZZ = LGHCMZZ / 42
- LGHCPUS = ΣLGHCPZZ

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:

$$\text{LGRCPZZ} = \text{LGHCPZZ} * \text{LGRCSZZ}$$

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

$$\text{LGCCPZZ} = \text{LGHCPZZ} * \text{LGCCSZZ}$$

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

$$\text{LGACPZZ} = \text{LGCBPZZ} * \text{LGTRSUS}$$

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:

$$\text{LGTCPZZ} = (\text{LGTTPZZ} / \text{LGTTPUS}) * \text{LGTCPUS}$$

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:

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

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

For 2008 and 2009, 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:

$$\begin{aligned} \text{LGCBPZZ} &= \text{LGCBMZZ} / 42 \\ \text{LGHCPZZ} &= \text{LGHCMZZ} / 42 \\ \text{LGRCPZZ} &= \text{LGHCPZZ} * \text{LGRCSZZ} \\ \text{LGCCPZZ} &= \text{LGHCPZZ} * \text{LGCCSZZ} \\ \text{LGACPZZ} &= \text{LGCBPZZ} * \text{LGTRSUS} \end{aligned}$$

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:

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

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 (LGTCBUS) with an average conversion factor for LPG. The factor for converting LPG from physical unit values to Btu, LGTCKUS, is calculated annually for 1967 through 2009 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, beginning on page 203. For 1960 through 1966, EIA adopted the 1967 calculated average heat content of 3.810 million Btu per barrel.

$$\begin{aligned} \text{LGTCBUS} &= \text{LPG total consumption in the United States, in billion Btu (through 2009); and} \\ \text{LGTCKUS} &= \text{Factor for converting U.S. consumption of LPG from physical units to Btu (through 2009).} \end{aligned}$$

Because the residential, commercial, and transportation sectors consume mainly propane, it is more appropriate to use the heat content of propane (3.841 million Btu per barrel) to convert LPG consumption for these three sectors into Btu:

$$\begin{aligned} \text{LGACBZZ} &= \text{LGACPZZ} * 3.841 \\ \text{LGCCBZZ} &= \text{LGCCPZZ} * 3.841 \\ \text{LGRCBZZ} &= \text{LGRCPZZ} * 3.841 \end{aligned}$$

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:

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

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:

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

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 TN4.2 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 TN4.2 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.
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 72). 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 TN4.3.
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 through 2009. 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

Table TN4.2. 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%

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. Before 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.

- 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

Table TN4.3. Transportation sector share of LPG internal combustion engine use, 1960 through 2009

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

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.

- Before 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 on page 46. 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 TN4.4) 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.
- 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 natural gasoline (pentanes plus); the natural

Table TN4.4. 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

gasoline data were removed by EIA before 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 before use in SEDS.

Data sources

LGCBMZZ — LPG sold for internal combustion engine use by state (through 2009). 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 45.

- 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 through 2009, some data are adjusted and estimated by EIA. (See explanation in Note 7 on page 46.)

- 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 and 2009: 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 (through 2009).

- 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 and 2009: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table B.

LGHCMZZ — LPG sold for residential and commercial use by state (through 2009). 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 45.

- 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 through 2009, some data are adjusted and estimated by EIA. (See explanation in Note 7, on page 46).

- 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 and 2009: 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 (through 2009).

- 1960 through 2007: Calculated in SEDS.
- 2008 and 2009: 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 (through 2009).

- 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 and 2009: American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table B.

LGTCBUS — LPG total consumption in the United States, in billion Btu (through 2009).

- 1960 through 1972: EIA, *Annual Energy Review*, Table 5.12.
- 1973 through 2009: EIA, *Monthly Energy Review*, Table 3.6.

LGTCBUS — Factor for converting LPG from physical units to Btu (through 2009).

- 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 through 2009: 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 185. Quantities consumed are from
 - 1967 through 1980: EIA, *Energy Data Reports*, “Petroleum Statement, Annual,” Table 1.
 - 1981 through 2009: 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 through 2009: Table 1.

LGTCBUS — LPG total consumption in the United States (through 2009).

- 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 2009: 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 through 2009: Table 1.

LGTRSUS — The transportation sector share of LPG internal combustion engine sales (through 2009).

- 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 45.

LGTPZZ — LPG total sales for all uses by state (through 2009).

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 45.

- 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 through 2009, some data are adjusted and estimated by EIA. (See explanation in Note 7, on page 46).

- 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 and 2009: 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.

Natural gasoline (formerly pentanes plus)

Before 2010, natural gasoline (formerly called pentanes plus) consumption is assumed to be equal to historical pentanes plus consumption, which included historical natural gasoline, plant condensate, pentanes plus, and unfractionated streams.

NATCPUS	=	historical natural gasoline (including isopentane) total consumption in the United States, in thousand barrels (through 1983);
PLTCPUS	=	plant condensate total consumption in the United States, in thousand barrels (through 1983);
PPTCPUS	=	pentanes plus (natural gasoline) total consumption in the United States, in thousand barrels (1984 through 2009); and
USTCPUS	=	unfractionated streams total consumption in the United States, in thousand barrels (through 1983).

All natural gasoline consumption is assumed to be in the industrial sector. This section covers natural gasoline consumption for 1960 through 2009.

For 2010 forward, SEDS reports natural gasoline (pentanes plus) as a HGL product. See Hydrocarbon Gas Liquids (2010 Forward).

Physical units

Natural gasoline (formerly pentanes plus) is used mainly as petrochemical feedstocks in the same way as naphtha. All natural gasoline consumption is assumed to be in the industrial sector.

Historical natural gasoline (including isopentane), plant condensate, and unfractionated streams are discontinued from the source after 1983. Beginning in 1984, historical natural gasoline and plant condensate are reported together as a new product, pentanes plus; and unfractionated streams are discontinued because its components are reported separately as liquefied petroleum gases. These products are used mostly as petrochemical feedstocks.

To allocate the U.S. consumption of these products to the states, the state

shares of capacity of steam crackers using naphthas (FNCASZZ) are used. The method of estimation of FNCASZZ is discussed on page 85.

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

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

Pentanes plus (natural gasoline) state and U.S. consumption are estimated:

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

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:

$$\begin{aligned} \text{USTCPZZ} &= \text{USTCPUS} * \text{FNCASZZ} \\ \text{USICPZZ} &= \text{USTCPZZ} \\ \text{USICPUS} &= \text{USTCPUS} \end{aligned}$$

British thermal units (Btu)

Btu estimates for the four historical natural gasoline (pentanes plus) products 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

$$\begin{aligned} \text{NATCBZZ} &= \text{NATCPZZ} * 4.638 \\ \text{NATCBUS} &= \sum \text{NATCBZZ} \\ \text{NAICBZZ} &= \text{NATCBZZ} \\ \text{NAICBUS} &= \text{NATCBUS} \\ \text{PLTCBZZ} &= \text{PLTCPZZ} * 5.418 \\ \text{PLTCBUS} &= \sum \text{PLTCBZZ} \\ \text{PLICBZZ} &= \text{PLTCBZZ} \\ \text{PLICBUS} &= \text{PLTCBUS} \\ \text{PPTCBZZ} &= \text{PPTCPZZ} * 4.638 \end{aligned}$$

$$\begin{aligned} \text{PPTCBUS} &= \sum \text{PPTCBZZ} \\ \text{PPICBZZ} &= \text{PPTCBZZ} \\ \text{PPICBUS} &= \text{PPTCBUS} \\ \text{USTCBZZ} &= \text{USTCPZZ} * 3.800 \\ \text{USTCBUS} &= \sum \text{USTCBZZ} \\ \text{USICBZZ} &= \text{USTCBZZ} \\ \text{USICBUS} &= \text{USTCBUS} \end{aligned}$$

Additional note

Before the 2010 cycle, natural gasoline (pentanes plus) was 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 more than 25 states, most of which did not produce petrochemicals. The steam cracker capacity shares, while requiring estimations, are better allocators.

Data sources

NATCPUS — Natural gasoline total consumption in the United States (through 1983).

- 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.

PLTCPUS — Plant condensate total consumption in the United States (through 1983).

- 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.

PPTCPUS — Pentanes plus (natural gasoline) total consumption in the United States.

- 1960 through 1983: Data were reported separately as natural gasoline, isopentane, and plant condensate.
- 1984 through 2009: 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 through 2009: Table 1.

USTCPUS — Unfractionated streams total consumption in the United States (through 1983).

- 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."

Hydrocarbon gas liquids (HGL)

Before 2010, HGL consumption is defined as the sum of LPG and pentanes plus (natural gasoline). Because pentanes plus is only used in the industrial sector, HGL consumption in the other end-use sectors is equal to LPG consumption:

$$\begin{aligned}
 \text{HLRCPZZ} &= \text{LGRCPZZ} \\
 \text{HLCCPZZ} &= \text{LGCCPZZ} \\
 \text{HLACPZZ} &= \text{LGACPZZ} \\
 \\
 \text{HLRCBZZ} &= \text{LGRCBZZ} \\
 \text{HLCCBZZ} &= \text{LGCCBZZ} \\
 \text{HLACBZZ} &= \text{LGACBZZ}
 \end{aligned}$$

Before 1984, industrial sector HGL consumption is equal to:

$$\begin{aligned}
 \text{HLICPZZ} &= \text{LGICPZZ} + \text{NATCPZZ} + \text{PLTCPZZ} + \text{USTCPZZ} \\
 \text{HLICBZZ} &= \text{LGICBZZ} + \text{NATCBZZ} + \text{PLTCBZZ} + \text{USTCBZZ}
 \end{aligned}$$

For 1984 through 2009, industrial sector HGL consumption is equal to:

$$\begin{aligned}
 \text{HLICPZZ} &= \text{LGICPZZ} + \text{PPICPZZ} \\
 \text{HLICBZZ} &= \text{LGICBZZ} + \text{PPICBZZ}
 \end{aligned}$$

Total HGL consumption is the sum of the end-use consumption estimates:

$$\begin{aligned}
 \text{HLTCPZZ} &= \text{HLACPZZ} + \text{HLCCPZZ} + \text{HLICPZZ} + \text{HLRCPZZ} \\
 \text{HLTCBZZ} &= \text{HLACBZZ} + \text{HLCCBZZ} + \text{HLICBZZ} + \text{HLRCBZZ}
 \end{aligned}$$

Total U.S. HGL consumption in physical unit is the sum of the product supplied

of LPG and pentanes plus:

Before 1984:

$$\text{HLTCPUS} = \text{LGTCPUS} + \text{NATCPUS} + \text{PLTCPUS} + \text{USTCPUS}$$

For 1984 through 2009:

$$\text{HLTCPUS} = \text{LGTCPUS} + \text{PPTCPUS}$$

The U.S. totals for all other HL consumption series are calculated as the sum of the state values.

Hydrocarbon Gas Liquids (2010 Forward)

Hydrocarbon gas liquids (HGL) cover natural gas liquids (ethane, propane, normal butane, isobutane, and natural gasoline) and refinery olefins (ethylene, propylene, butylene, and isobutylene). Refinery olefins are olefins produced at refineries and do not include olefins produced by the manufacturing industries. The State Energy Data System (SEDS) estimates HGL consumption for the residential, commercial, industrial, and transportation sectors. SEDS assumes that, except for propane, all other HGL products are consumed only by the industrial sector.

For 2010 forward, the U.S. Energy Information Administration (EIA) publishes U.S. products supplied data for total HGL and the nine HGL products, which are used to define U.S. consumption in SEDS:

HLTCPUS	=	hydrocarbon gas liquids total consumption in the United States, in thousand barrels;
BQTCPUS	=	normal butane total consumption in the United States, in thousand barrels;
BYTCPUS	=	butylene from refineries total consumption in the United States, in thousand barrels;
EQTCPUS	=	ethane total consumption in the United States, in thousand barrels;
EYTCPUS	=	ethylene from refineries total consumption in the United States, in thousand barrels;
IQTCPUS	=	isobutane total consumption in the United States, in thousand barrels;
IYTCPUS	=	isobutylene from refineries total consumption in the United States, in thousand barrels;
PPTCPUS	=	natural gasoline (pentanes plus) total consumption in the United States, in thousand barrels;
PQTCPUS	=	propane total consumption in the United States, in thousand barrels; and
PYTCPUS	=	propylene from refineries total consumption in the United States, in thousand barrels.

Natural gasoline (pentanes plus), which was included in “other petroleum products” through 2015 SEDS reports, is included here in HGL.

SEDS estimates state-level HGL consumption using a combination of EIA estimates, American Petroleum Institute’s (API) *Sales of Natural Gas Liquids and Liquefied Refinery Gases* (for 2010 through 2016), Propane Education & Research Council’s (PERC) *Retail Propane Sales Report* (for 2017 forward), and

Oil and Gas Journal (OGJ) ethylene steam cracker capacity data.

Residential sector

Physical units

SEDS assumes all residential sector HGL consumption to be equal to residential propane consumption.

PQRCPPZ = propane consumed by the residential sector, in thousand barrels.

For 2010 through 2016, SEDS estimates state-level residential sector propane consumption using API’s *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, sales of odorized propane for the residential sector and sales for retailers. For 2017 forward, SEDS estimates state-level residential sector propane consumption using PERC’s *Retail Propane Sales Report*, sales of odorized propane for the residential sector and for cylinder markets. The sources report sales data in gallons and SEDS converts the data to barrels (42 gallons per barrel) for total SEDS residential sector propane consumption estimates.

Residential sector HGL consumption in each state, HLRCPPZ, equals residential propane consumption:

HLRCPPZ = PQRCPPZ

The U.S. totals for the state data series are the sum of the state values.

Commercial sector

Physical units

SEDS assumes all commercial sector HGL consumption to be equal to commercial propane consumption.

PQCCPPZ = propane consumed by the commercial sector, in thousand barrels.

SEDS estimates state-level commercial sector propane consumption using sales of odorized propane for the commercial sector reported in the API report (2010- 2016) or the PERC report (2017 forward). The sources report sales data in gallons and SEDS converts the data to barrels (42 gallons per barrel) for total SEDS commercial sector consumption estimates.

Commercial sector HGL consumption in each state, HLCCPPZ, equals

commercial propane consumption:

$$HLCCPZZ = PQCCPZZ$$

The U.S. totals for the state data series are the sum of the state values.

Industrial sector

For 2010 forward, SEDS estimates state-level industrial sector consumption for nine HGL components: normal butane, butylene, ethane, ethylene, isobutane, isobutylene, natural gasoline (pentanes plus), propane, and propylene.

Propane physical units

For 2010 forward, SEDS uses a new method to estimate the consumption of propane in the United States by the industrial sector and allocation to the states.

$$PQICPZZ = \text{propane consumed by the industrial sector, in thousand barrels.}$$

Propane consumed by the industrial sector is defined by two categories: other odorized industrial propane and industrial propane for chemical use. To calculate other odorized industrial propane consumption, SEDS subtracts the sum of residential, commercial, and transportation sectors' propane consumption for each state from the state's total odorized propane sales, available in the API report (2010-2016) or the PERC report (2017 forward). To calculate industrial propane for chemical use for the United States, SEDS subtracts U.S. total odorized propane sales from U.S. total propane consumption. SEDS uses propane chemical feedstock capacity of ethylene steam crackers from OGJ (2010-2014) or estimated by EIA (2015 forward) to allocate consumption to states. SEDS estimates total industrial propane consumption as the sum of other odorized industrial propane consumption and industrial propane consumption for chemical use. The sources report the data in gallons and SEDS converts the data to barrels (42 gallons per barrel) for total SEDS industrial sector consumption estimates.

Other HGL physical units

SEDS assumes all other HGL products (normal butane, butylene, ethane, ethylene, isobutane, isobutylene, natural gasoline, and propylene) are consumed only by the industrial sector.

$$BQTCPZZ = \text{normal butane total consumption, in thousand barrels;}$$

- BYTCPZZ = butylene from refineries total consumption, in thousand barrels;
- EQTCPZZ = ethane total consumption, in thousand barrels;
- EYTCPZZ = ethylene from refineries total consumption, in thousand barrels;
- IQTCPZZ = isobutane total consumption, in thousand barrels;
- IYTCPZZ = isobutylene from refineries total consumption, in thousand barrels;
- PPTCPZZ = natural gasoline (pentanes plus) total consumption, in thousand barrels; and
- PYTCPZZ = propylene from refineries total consumption, in thousand barrels.

SEDS calculates state-level estimates for other HGL products by applying state shares estimated by EIA to the U.S. product supplied for each HGL type.

For normal butane, SEDS estimates consumption for Louisiana using capacities from Oil and Gas Journal (OGJ) ethylene crackers feed slates for n-butane. The remainder is assigned to Texas.

For butylene, SEDS estimates state allocations using SEDS naphtha feedstock capacity shares, based on OGJ data, scaled to total U.S. butylene product supplied from PSA. SEDS assumes all consumption is in Louisiana and Texas.

For ethane, SEDS estimates consumption for Illinois, Iowa, Kentucky, and Louisiana using ethane feedstock plant nameplate capacities for plants in those states, compiled by EIA based on OGJ (2010-2014) and plant-level information. The remainder is assigned to Texas.

For ethylene, SEDS estimates state consumption using total U.S. ethylene product supplied from PSA and allocated proportionally to states based on SEDS ethane consumption estimates.

For isobutane, SEDS assumes all U.S. consumption is in Texas.

For isobutylene, SEDS estimates state allocations using SEDS naphtha feedstock capacity shares, based on OGJ data, scaled to total U.S. isobutylene product supplied from PSA. SEDS assumes all consumption is in Louisiana and Texas.

For natural gasoline, SEDS estimates state allocations using SEDS naphtha feedstock capacity shares, based on OGJ data, scaled to total U.S. natural gasoline product supplied from PSA. SEDS assumes all consumption is in Louisiana and Texas.

For propylene, SEDS estimates state allocations using EIA estimated plant

production capacities of products using propylene as feedstock, scaled to total U.S. propylene product supplied from PSA. SEDS assumes all consumption is in California, Illinois, Kentucky, Louisiana, New Jersey, Ohio, Pennsylvania, Texas, and West Virginia.

Industrial sector consumption by state for each of the other HGL products is equal to its total consumption. For example:

$$BQICPZZ = BQTCPZZ$$

Total industrial HGL consumption for each state is equal to:

$$HLICPZZ = BQICPZZ + BYICPZZ + EQICPZZ + EYICPZZ + IQICPZZ + IYICPZZ + PPICPZZ + PQICPZZ + PYICPZZ$$

The U.S. totals for the state data series are the sum of the state values.

Transportation sector

Physical units

SEDS assumes all transportation sector HGL consumption to be equal to transportation propane consumption.

For 2010 forward, SEDS uses a new method to estimate the consumption of propane in the United States by the transportation sector and allocation to the states:

$$PQACPZZ = \text{propane consumed by the transportation sector, in thousand barrels.}$$

Total U.S. consumption of propane by the transportation sector, in British thermal units (Btu), comes from the U.S. Energy Information Administration's (EIA) *Annual Energy Outlook*, supplemental table titled "Transportation Sector Energy Use by Fuel Type within Mode." SEDS converts the Btu consumption values to barrels using the propane Btu conversion factor (3.841 million Btu per barrel).

For 2010 through 2016, SEDS assumes that fleet vehicles, including all medium-duty and heavy-duty vehicles and some light-duty vehicles, consume 65% of propane. SEDS assumes other light-duty vehicles consume the remaining 35%.

To allocate medium-duty and heavy-duty vehicles to the states, SEDS uses propane consumption data from Form EIA-886 "Annual Survey of Alternative Fueled Vehicles" to calculate state shares. For light-duty vehicles, SEDS uses

the U.S. Department of Transportation, Federal Highway Administration publication, *Highway Statistics*, Table VM-2, "Vehicle-miles of travel, by functional system" to calculate state shares. Lastly, SEDS sums the state allocations for the two categories to calculate the final state consumption.

For 2017 forward, SEDS uses unpublished propane autogas sales data from PERC to allocate the U.S. consumption of propane by the transportation sector to the states.

Transportation sector HGL consumption in each state, HLACPZZ, equals transportation propane consumption:

$$HLACPZZ = PQACPZZ$$

The U.S. totals for the state data series are the sum of the state values.

Total

Physical units

Total HGL consumption is the sum of the end-use consumption estimates:

$$HLTCPZZ = HLACPZZ + HLCCPZZ + HLICPZZ + HLRCPZZ$$

Total propane consumption is also calculated:

$$PQTCPZZ = PQACPZZ + PQCCPZZ + PQICPZZ + PQRCPZZ$$

All sectors

British thermal units (Btu)

SEDS calculates Btu estimates for each of the nine HGL products as the product of the estimated consumption of each product in physical units by its respective Btu conversion factor. The calculations performed to estimate residential, commercial, industrial, and total propane Btu consumption, and industrial and total other HGL Btu consumption by state and for the United States are:

$$\begin{aligned} BQICBZZ &= BQICPZZ * 4.353 \\ BQICBUS &= \sum BQICBZZ \\ BQTCBZZ &= BQTCPZZ * 4.353 \\ BQTCBUS &= \sum BQTCBZZ \\ BYICBZZ &= BYICPZZ * 4.377 \\ BYICBUS &= \sum BYICBZZ \end{aligned}$$

BYTCBZZ	=	BYTCPZZ * 4.377
BYTCBUS	=	ΣBYTCBZZ
EQICBZZ	=	EQICPZZ * 2.783
EQICBUS	=	ΣEQICBZZ
EQTCBZZ	=	EQTCPZZ * 2.783
EQTCBUS	=	ΣEQTCBZZ
EYICBZZ	=	EYICPZZ * 2.436
EYICBUS	=	ΣEYICBZZ
EYTCBZZ	=	EYTCPZZ * 2.436
EYTCBUS	=	ΣEYTCBZZ
IQICBZZ	=	IQICPZZ * 4.183
IQICBUS	=	ΣIQICBZZ
IQTCBZZ	=	IQTCPZZ * 4.183
IQTCBUS	=	ΣIQTCBZZ
IYICBZZ	=	IYICPZZ * 4.355
IYICBUS	=	ΣIYICBZZ
IYTCBZZ	=	IYTCPZZ * 4.355
IYTCBUS	=	ΣIYTCBZZ
PPICBZZ	=	PPICPZZ * 4.638
PPICBUS	=	ΣPPICBZZ
PPTCBZZ	=	PPTCPZZ * 4.638
PPTCBUS	=	ΣPPTCBZZ
PQACBZZ	=	PQACPZZ * 3.841
PQACBUS	=	ΣPQACBZZ
PQCCBZZ	=	PQCCPZZ * 3.841
PQCCBUS	=	ΣPQCCBZZ
PQICBZZ	=	PQICPZZ * 3.841
PQICBUS	=	ΣPQICBZZ
PQRCBZZ	=	PQRCPZZ * 3.841
PQRCBUS	=	ΣPQRCBZZ
PYICBZZ	=	PYICPZZ * 3.835
PYICBUS	=	ΣPYICBZZ
PYTCBZZ	=	PYTCPZZ * 3.835
PYTCBUS	=	ΣPYTCBZZ

Estimated consumption of HGL in Btu is the sum of the Btu consumption of each product by the corresponding sector. The state and U.S. totals are calculated:

HLACBZZ	=	PQACBZZ
HLACBUS	=	ΣHLACBZZ
HLCCBZZ	=	PQCCBZZ

HLCCBUS	=	ΣHLCCBZZ
HLICBZZ	=	BQICBZZ + BYICBZZ + EQICBZZ + EYICBZZ + IQICBZZ + IYICBZZ + PPICBZZ + PQICBZZ + PYICBZZ
HLICBUS	=	ΣHLICBZZ
HLRCBZZ	=	PQRCBZZ
HLRCBUS	=	ΣHLRCBZZ

Total HGL and propane consumption in Btu are the sum of the sectors:

PQTCBZZ	=	PQACBZZ + PQCCBZZ + PQICBZZ + PQRCBZZ
PQTCBUS	=	ΣPQTCBZZ

HLTCBZZ	=	HLACBZZ + HLCCBZZ + HLICBZZ + HLRCBZZ
HLTCBUS	=	ΣHLTCBZZ

Additional calculations

SEDS combines the consumption of HGL products other than propane for the SEDS price and expenditure calculations. They include normal butane, butylene, ethane, ethylene, isobutane, isobutylene, natural gasoline, and propylene. The variables are calculated in Btu, for each state and the United States:

OHICBZZ	=	BQICBZZ + BYICBZZ + EQICBZZ + EYICBZZ + IQICBZZ + IYICBZZ + PPICBZZ + PYICBZZ
OHICBUS	=	ΣOHICBZZ

SEDS calculates the average Btu conversion factor for industrial sector HGL consumption as:

HLICKZZ	=	HLICBZZ / HLICPZZ
HLICKUS	=	HLICBUS / HLICPUS
HLTCKZZ	=	HLTCBZZ / HLTCPZZ
HLTCKUS	=	HLTCBUS / HLTCPUS

Data sources

BQTCPUS — Normal butane total consumption in the United States.
BQTCPZZ — Normal butane total consumption by state.

- 2010 forward: Estimated using 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,” Table 1 and ethylene crackers feed slates for n-butane from the *Oil and Gas Journal*. For 2015, information on n-butane feed slate capacity of ethylene steam crackers are no longer available from OGJ. The 2014 volumes are used for 2015 forward.

BYTCPUS — Butylene from refineries total consumption in the United States.
BYTCPZZ — Butylene from refineries total consumption by state.

- 2010 forward: Estimated using 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,” Table 1 and state’s share of U.S. capacity of steam crackers using naphtha as feedstocks (FNCAS):
 - 2010 through 2014: *Oil and Gas Journal*, specific issues focusing on ethylene production, table on “International Survey of Ethylene from Steam Crackers.”
 - 2015 forward: EIA estimation, based on data available from the *Oil and Gas Journal*.

EQTCPUS — Ethane total consumption in the United States.
EQTCPZZ — Ethane total consumption by state.

- 2010 forward: Estimated using 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,” Table 1, and data on ethane feedstock capacity of ethylene steam crackers estimated by EIA.

EYTCPUS — Ethylene from refineries total consumption in the United States.
EYTCPZZ — Ethylene from refineries total consumption by state.

- 2010 forward: Estimated using 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,” Table 1, and data on ethane feedstock capacity of ethylene steam crackers estimated by EIA.

HLTCPUS — Hydrocarbon gas liquids total consumption in the United States.

- 2010 forward: Estimated using 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,” Table 1.

IQTCPUS — Isobutane total consumption in the United States.
IQTCPZZ — Isobutane total consumption by state.

- 2010 forward: Estimated using 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,” Table 1.

IYTCPUS — Isobutylene from refineries total consumption in the United States.

IYTCPZZ — Isobutylene from refineries total consumption by state.

- 2010 forward: Estimated using 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,” Table 1 and state’s share of U.S. capacity of steam crackers using naphtha as feedstocks (FNCAS):
 - 2010 through 2014: *Oil and Gas Journal*, specific issues focusing on ethylene production, table on “International Survey of Ethylene from Steam Crackers.”
 - 2015 forward: EIA estimation, based on data available from the *Oil and Gas Journal*.

PPTCPUS — Natural gasoline (pentanes plus) total consumption in the United States.

PPTCPZZ — Natural gasoline (pentanes plus) total consumption by state.

- 2010 forward: Estimated using 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,” Table 1 and state’s share of U.S. capacity of steam crackers using naphtha as feedstocks (FNCAS):
 - 2010 through 2014: *Oil and Gas Journal*, specific issues focusing on

ethylene production, table on “International Survey of Ethylene from Steam Crackers.”

- 2015 forward: EIA estimation, based on data available from the *Oil and Gas Journal*.

PQACBUS — Propane consumed by the transportation sector, United States.

- 2010 forward: EIA, *Annual Energy Outlook*, http://www.eia.gov/outlooks/aeo/tables_ref.php, supplemental table titled “Transportation Sector Energy Use by Fuel Type Within a Mode” and historical estimates.

PQACPZZ — Propane consumed by the transportation sector by state.

- 2010 through 2016: State allocators estimated using Form EIA-886, <http://www.eia.gov/renewable/afv/users.php?fs=a&ufueltype=LPG>, Annual “Survey of Alternative Fueled Vehicles,” and Federal Highway Administration, *Highway Statistics*, <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>, Table VM-2.
- 2017 forward: State allocators estimated using the Propane Education & Research Council, *Retail Propane Sales Report*.

PQCCPZZ — Propane consumed by the commercial sector by state.

- 2010 through 2016: Odorized propane sold for the commercial sector by state, published by the American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table C.
- 2017 forward: Odorized propane sold for the commercial sector by state, published by the Propane Education & Research Council, *Retail Propane Sales Report*.

PQICPZZ — Propane consumed by the industrial sector by state.

- 2010 forward: Estimated using 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,” Table 1 and data on propane feedstock capacity of ethylene steam crackers estimated by EIA.
 - 2010 through 2016: Estimated using total odorized propane by state, published by the American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table C.
 - 2017 forward: Estimated using total odorized propane by state,

published by the Propane Education & Research Council, *Retail Propane Sales Report*.

PQRCPZZ — Propane consumed by the residential sector by state.

- 2010 through 2016: Odorized propane sold for the residential sector and sales for retailers by state, published by the American Petroleum Institute, *Sales of Natural Gas Liquids and Liquefied Refinery Gases*, Table C.
- 2017 forward: Odorized propane sold for the residential sector and for cylinder markets by state, published by the Propane Education & Research Council, *Retail Propane Sales Report*.

PQTCBUS — Propane total consumption in the United States.

- 2010 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,” Table 1.

PYTCPUS — Propylene from refineries total consumption in the United States.

PYTCPZZ — Propylene from refineries total consumption by state.

- 2010 forward: Estimated using 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,” Table 1.

Jet Fuel

Jet fuel is used primarily by aircraft for transportation, although small amounts of kerosene-type jet fuel are also used to generate electricity 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). The State Energy Data System (SEDS) estimates total jet fuel (JF) as the sum of the two series. Beginning in 2005, the data source includes naphtha-type jet fuel in “Miscellaneous Petroleum Products,” and SEDS no longer estimates naphtha-type jet fuel consumption separately.

Kerosene-type jet fuel

Physical units

For 2005 forward, SEDS only estimates kerosene-type jet fuel and assumes it is only for aircraft consumption in the transportation sector. Before 1983, SEDS also estimates some kerosene-type jet fuel used in the electric power sector. The 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):

JKTCBUS	=	kerosene-type jet fuel total consumption in the United States, in thousand barrels;
JKEUPZZ	=	electric utility sector consumption of kerosene-type jet fuel by state, in thousand barrels (through 1982); and
JKTTPZZ	=	kerosene-type jet fuel sales (through 2009) or estimated use (for 2010 forward) by state, in thousand gallons.

Total U.S. consumption of kerosene-type jet fuel, JKTCBUS, is the product supplied data series in the U.S. Energy Information Administration’s (EIA) *Petroleum Supply Annual*.

For 1972 through 1982, EIA’s *Cost and Quality of Fuels for Electric Utility Plants* report published kerosene-type jet fuel consumed by electric utilities in the electric power sector, JKEUPZZ. SEDS assumes consumption from 1983 forward to be zero. For 2001 forward, the source includes any jet fuel used for electric power generation in waste/other oil. SEDS does not process data for waste/other oil because waste oil is not primary energy—consumption of the petroleum products that produced the waste oil has already been accounted for. As such, SEDS data include a small volume of jet fuel used for electric power generation in the SEDS transportation sector consumption.

To allocate U.S. kerosene-type jet fuel consumption (JKTCBUS) to the states, SEDS uses a data series that approximates jet fuel consumption (JKTTPZZ) as state allocators. For 1960 through 1983, JKTTPZZ represents aviation turbine fuel sales collected by the Ethyl Corporation, Petroleum Chemical Division. For 1984 through 2009, it represents volume of first sales for consumption and, in later years, prime supplier sales collected in EIA surveys. For 2010 forward, it is an approximation of jet fuel use for commercial aviation and general aviation compiled using data from the Airlines for America (A4A) and U.S. Department of Transportation, Bureau of Transportation Statistics (BTS) and Federal Aviation Administration (FAA).

For 1960 through 1983, SEDS uses the Ethyl Corporation data on sales to commercial users to represent total sales based on the assumption that there is little military use of kerosene-type jet fuel.

For 1984 through 2009, EIA data include commercial and military sales. Data for 1984 through 1993 are from EIA’s *Petroleum Marketing Annual* (PMA). Data for 1994 forward are unpublished data, in thousand gallons, and are available in thousand gallons per day in PMA and on the EIA website. Before 1994, SEDS estimates withheld data 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. For 1994 through 2009, SEDS estimates withheld data using historical growth rates or state shares. They include Arizona (2009), Delaware (1995, 1997, and 1998), Hawaii (2002–2004, 2008, and 2009), New Hampshire (2009), Oregon (2002–2004 and 2008), and Vermont (2009). SEDS assumes kerosene-type jet fuel sales in the District of Columbia to be zero (1994–2009).

For 2010 forward, SEDS estimates commercial aviation use of jet fuel using A4A and BTS data and general aviation use of jet fuel using unpublished FAA data from the *General Aviation and Part 135 Activity Survey*.

For commercial aviation, SEDS takes annual jet fuel volume data for about 75 to 92 U.S. airports collected by A4A. Using BTS’s “Air Carrier Statistics (Form 41 Traffic)—All Carriers” database, “T-100 Segment (All Carriers)” table, SEDS calculates the “total ton-miles” (equal to the product of the estimated total weight of the aircraft, passengers, and cargo multiplied by flight distances) for each origin airport. SEDS first uses the total ton-miles (TTM) data to fill in earlier missing A4A data assuming the growth rates of the airport-level jet fuel volume and TTM are the same. Then, for each year, SEDS calculates a simple ratio of jet fuel volume and TTM for the airports covered in the A4A dataset and applies it to the TTM of all the other U.S. airports to estimate their jet fuel use for commercial aviation. SEDS aggregates the estimates at the airport level to the state level.

For general aviation, the FAA survey collects data by state where the aircraft was primarily flown during the year. SEDS assumes that jet fuel consumption reported for the District of Columbia are for aircrafts that originated in Maryland and Virginia and allocates it equally between the two states. The FAA state-level data are not available for 2010 and 2011. SEDS applies the 2012 state shares to the U.S. general aviation jet fuel consumption for those two years to derive the state estimates.

The estimates of commercial and general aviation jet fuel use are summed to JKTPZZ.

U.S. totals for the two state data series, JKEUPZZ and JKTPZZ, are the sum of the state data.

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

$$JKACPUS = JKCPUS - JKEUPUS$$

SEDS allocates total U.S. jet fuel consumption by the transportation sector to the states using the JKTPZZ state shares:

$$JKACPZZ = (JKTPZZ / JKTPUS) * JKACPUS$$

SEDS estimates total kerosene-type jet fuel by state as:

$$JKTCPZZ = JKACPZZ + JKEUPZZ$$

British thermal units (Btu)

EIA assumes kerosene-type jet fuel has a heat content value of about 5.670 million Btu per barrel. SEDS uses this factor to convert kerosene-type jet fuel from physical units to Btu:

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

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. Before 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 TN4.5 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 (through 1982).

- 1960 through 1971: No data available. Values are assumed to be zero.

Table TN4.5. 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

- 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.

JKTTPZZ — Kerosene-type jet fuel sales or estimated use 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 through 2009: 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: Estimated by EIA based on unpublished airport jet fuel consumption data from Airlines for America (A4A), published "Air Carrier Statistics (Form 41 Traffic) — All Carriers", **T-100 Segment (All Carriers)**, data from the U.S. Bureau of Transportation Statistics (BTS), and unpublished *General Aviation and Part 135 Activity Survey* data from the U.S. Federal Aviation Administration (FAA).

JKTCPUS — Kerosene-type jet fuel total consumption 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

SEDS uses two data series to estimate naphtha-type jet fuel consumption:

- JNTCPUS = naphtha-type jet fuel total consumption, 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

EIA. Beginning in 2005, it is included in “Miscellaneous Petroleum Products,” and is assigned a zero value in SEDS.

SEDS assumes that military aircraft consumes all naphtha-type jet fuel. (See the Additional Notes at the end of this section.) The U.S. Department of Defense, Defense Logistics Agency, Defense Supply Center provides naphtha-type jet fuel issued to the military in each state, JNMIPZZ.

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

$$JNMIPUS = \sum JNMIPZZ$$

SEDS estimates naphtha-type jet fuel consumption by state, JNTCPZZ, assuming that each state consumes naphtha-type jet fuel in proportion to the amount issued to the military in that state:

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

SEDS assumes all naphtha-type jet fuel is for transportation purposes:

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

British thermal units (Btu)

EIA assumes naphtha-type jet fuel has a heat content value of 5.355 million Btu per barrel. SEDS uses this factor to convert naphtha-type jet fuel from physical units to Btu:

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

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

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

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. Because 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 consumption 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.

Jet fuel totals

Physical units

SEDS calculates total jet fuel consumption estimates by end-use sector in physical units:

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

British thermal units (Btu)

SEDS calculates total jet fuel consumption estimates by end-use sector in Btu:

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

Kerosene

Physical units

The State Energy Data System (SEDS) estimates state-level kerosene consumption for the residential, commercial, and industrial sectors using four data series published by the U.S. Energy Information Administration (EIA) representing sales of kerosene into or within each state. SEDS uses a fifth data series, the U.S. total kerosene consumption, which is the product supplied series from EIA’s *Petroleum Supply Annual*. SEDS uses the four sales series as shares to allocate the known U.S. total consumption to the states and sectors. SEDS assigns the following variable names 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, in thousand barrels;
KSIHPZZ	=	kerosene sold to the industrial sector, in thousand barrels;
KSOTPZZ	=	kerosene sold for all other uses, including farm use, in thousand barrels;
KSRSPZZ	=	kerosene sold to the residential sector, in thousand barrels; and
KSTCPUS	=	kerosene total consumption in the United States, in thousand barrels.

SEDS calculates U.S. sales totals for each of the four state-level series as the sum of the state values. SEDS aligns the variables into the end-use sectors used in SEDS. The residential and commercial sectors contain only KSRSPZZ and KSCMPZZ, respectively.

SEDS calculates the sales of kerosene to the industrial sector, KSINPZZ, for each state as the sum of kerosene sold for industrial heating and processing (KSIHPZZ) and kerosene sold for all other uses (KSOTPZZ), including farm use:

$$\begin{aligned} \text{KSINPZZ} &= \text{KSOTPZZ} + \text{KSIHPZZ} \\ \text{KSINPUS} &= \sum \text{KSINPZZ} \end{aligned}$$

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

$$\begin{aligned} \text{KSTTPZZ} &= \text{KSRSPZZ} + \text{KSCMPZZ} + \text{KSINPZZ} \\ \text{KSTTPUS} &= \sum \text{KSTTPZZ} \end{aligned}$$

SEDS estimates each state's total consumption of kerosene by allocating the U.S. total consumption to the states in proportion to each state's share of the U.S. total sales:

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

SEDS estimates residential sector consumption, KSRCPZZ, by applying each state's residential sector sales percentage of total sales to the state's estimated total consumption:

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

SEDS estimates the commercial sector's estimated consumption in each state, KSCCPZZ, as:

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

SEDS estimates the industrial sector's estimated consumption in each state, KSICPZZ, as:

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

SEDS calculates U.S. totals for the three sectors' consumption as the sums of the states' estimated consumption.

Data on kerosene consumed by the electric power sector are not separately available before 2003. For 2003 forward, the source includes kerosene used for power generation in its waste/other oil category. SEDS doesn't estimate waste/other oil consumption to avoid double counting. Waste oil is not primary energy and SEDS accounts for waste oil consumption in its other petroleum product consumption estimates. While kerosene consumption by the electric power sector is not separately shown, SEDS does not underestimate total kerosene consumption because the U.S. product supplied data series covers all uses and sales of kerosene to the industrial sector include those for electric power use.

British thermal units (Btu)

EIA assumes kerosene has a heat content value of about 5.670 million Btu per barrel. SEDS applies this factor to convert estimated kerosene consumption from physical units to Btu:

$$\begin{aligned} KSRCBZZ &= KSRCPZZ * 5.670 \\ KSCCBZZ &= KSCCPZZ * 5.670 \\ KSICBZZ &= KSICPZZ * 5.670 \end{aligned}$$

SEDS calculates total state kerosene consumption in Btu as the sum of the end-use sectors:

$$KSTCBZZ = KSRCBZZ + KSCCBZZ + KSICBZZ$$

SEDS calculates U.S. Btu consumption estimates for the three consuming sectors and the U.S. total 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 59 for comments concerning the inclusion of kerosene-type jet fuel with the kerosene total product supplied before 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, 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.

- 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."

KSHPZZ — Kerosene sold to the industrial sector.

- 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 63.)
- 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.

- 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 63.)
- 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 consumption 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.

Lubricants

Physical units

The State Energy Data System (SEDS) estimates lubricant consumption for the industrial and transportation sectors.

For 1960 through 2009, SEDS uses three data series to estimate state consumption of lubricants. SEDS uses two state-level sales data series to allocate the U.S. total consumption data to the states and the end-use sectors. ("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 consumption in the United States, in thousand barrels.

SEDS uses data from the U.S. Census Bureau's *Current Industrial Reports: Sales of Lubricating and Industrial Oils and Greases* to estimate the first two variables. The report was discontinued after 1977. See the additional notes at the end of this section for a description of the estimation. The third variable for lubricants is the product supplied data series in the U.S. Energy Information Administration's (EIA) *Petroleum Supply Annual*. SEDS uses the first two variables to allocate the third into state total consumption and state end-use consumption estimates.

SEDS calculates total sales of lubricants for each state, LUTTPZZ, as the sum of the industrial and transportation sales:

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

U.S. total sales is the sum of the state sales.

SEDS uses each state's proportion of total U.S. sales to calculate each state's estimated consumption of lubricants:

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

SEDS estimates each state's lubricants consumption by end-use sector in proportion to that state's sales by sector as a portion of total sales in the state. SEDS calculates state lubricants consumption for industrial use, LUICPZZ, and for transportation use, LUACPZZ, as:

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

SEDS sums the state consumption estimates for these two end-use sectors to calculate the consumption of lubricants in the United States.

Beginning in 2010, SEDS uses a new method to estimate the consumption of lubricants in the United States for the industrial and transportation sectors and allocation to the states.

LUACPZZ	=	lubricants consumed by the transportation sector, in thousand barrels;
LUACPUS	=	lubricants consumed by the transportation sector, United States, in thousand barrels;
LUICPZZ	=	lubricants consumed by the industrial sector, in thousand barrels;
LUICPUS	=	lubricants consumed by the industrial sector, United States, in thousand barrels; and
LUTCPUS	=	lubricants total consumption in the United States, in thousand barrels.

SEDS uses finished lubricant demand data from Kline & Company, Inc. to compile shares for the industrial and transportation sectors. SEDS uses three market segments (industrial, consumer total, and commercial total) and two product types covered in the industrial market segment (marine and railroad) to compile the shares (see Table TN4.6).

SEDS applies the industrial share to U.S. total lubricant consumption to calculate U.S. lubricant consumption for the industrial sector, LUICPUS. SEDS uses the four other categories to calculate U.S. lubricant consumption for the transportation sector, which sum to LUACPUS.

SEDS estimates state allocators for the consumption of lubricants by the industrial sector using the use table of the latest benchmark input-output (I-O) accounts and real state gross domestic product (GDP) by industry, both published by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). One of the commodities in the I-O accounts is "other petroleum and coal products manufacturing" (North American Industry Classification System, NAICS, code 324190), which is mostly lubricants. First, SEDS compiles lubricant input per dollar output for 25 industries in the agriculture, mining, construction, and manufacturing sectors using the benchmark I-O accounts use table. Then, SEDS multiplies the industrial inputs by the real state GDP for the 25 industries. Lastly, SEDS sums the products to the state level to calculate state shares for lubricant consumption by the industrial

Table TN4.6. Shares of U.S. finished lubricant demand for five product categories, 2010 forward

Year	Industrial	Consumer Total	Commercial Total	Marine	Railroad
2010	46.7%	26.9%	22.0%	3.2%	1.2%
2011	46.2%	27.2%	22.2%	3.3%	1.2%
2012	46.6%	27.1%	22.0%	3.1%	1.2%
2013	46.6%	27.0%	22.0%	3.1%	1.2%
2014	46.7%	27.0%	22.1%	3.1%	1.2%
2015	46.6%	27.0%	22.1%	3.0%	1.3%
2016	46.7%	27.0%	22.0%	3.0%	1.2%
2017	46.8%	26.9%	22.1%	3.0%	1.2%
2018	47.1%	26.4%	22.2%	3.1%	1.2%
2019	47.4%	26.1%	22.2%	3.1%	1.2%

sector.

SEDS calculates state-level consumption of lubricants by the industrial sector, LUICPZZ, by applying the state allocators to the U.S. consumption.

SEDS estimates state allocators for the consumption of lubricants for each of the four categories in the transportation sector using the following data series:

- Motor gasoline consumption by the transportation sector (MGTRP) to allocate U.S. consumer total demand to the states
- Distillate fuel oil sales as diesel fuel for on-highway use (DFONP) to allocate U.S. commercial total demand to the states
- Distillate and residual fuel oil sales for vessel bunkering use (DFBKP and RFBKP) to allocate U.S. marine demand to the states
- Distillate fuel oil sales for railroad use (DFRRP) to allocate U.S. railroad demand to the states

SEDS sums the four data series to calculate state-level consumption of lubricants by the transportation sector, LUACPZZ.

British thermal units (Btu)

EIA assumes lubricants have a heat content value of about 6.065 million Btu per barrel. SEDS applies this factor to convert estimated lubricants 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:

Table TN4.7. Lubricants sales data used in consumption estimates, 1960 through 2009

Year of sales data	Year of consumption estimates
1960	1960 and 1961
1962	1962 through 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 through 2009

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

SEDS calculates the U.S. sector and total consumption estimates in Btu as the sum of the state data.

Additional notes

1. The lubricants sales data (LUINPZZ and LUTRPZZ) were published about 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 TN4.7 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. Before 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

LUACPZZ — Lubricants consumed by the transportation sector by state.

- 2010 forward: Estimated by EIA using state allocators derived from selected SEDS consumption series.

LUACPUS — Lubricants consumed by the transportation sector, United States.

- 2010 forward: Estimated by EIA based on Kline & Company data on finished lubricant demand for consumer total, commercial total, marine, and railroad use.

LUICPZZ — Lubricants consumed by the industrial sector by state.

- 2010 forward: Estimated by EIA using state allocators derived from U.S. Department of Commerce, Bureau of Economic Analysis, 2012 benchmark input-output accounts and real State Gross Domestic Products by Industry in chained (2012) dollars.

LUICPUS — Lubricants consumed by the industrial sector, United States.

- 2010 forward: Estimated by EIA based on Kline & Company data on finished lubricant demand for industrial (less marine and railroad) use.

LUINPZZ — Lubricants sold to the industrial sector by state (through 2009). 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 67.)

LUTCPUS — Lubricants total consumption 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 (through 2009). 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 67.)

Motor Gasoline

Physical units

The State Energy Data System (SEDS) uses twelve data series to estimate 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 SEDS includes them 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)

The 12th motor gasoline data series (MGTCPU) is total U.S. consumption of motor gasoline, which is the product supplied series in EIA’s *Petroleum Supply Annual*. MGTCPU includes fuel ethanol blended into motor gasoline. Before 1993, EIA underreported motor gasoline product supplied because it did not include all of the fuel ethanol blended with motor gasoline. The source also misreported volumes of motor gasoline blending components that were blended into finished motor gasoline. To adjust for the underreported data, SEDS added fuel ethanol consumption estimates to total energy consumption for years before 1993 (see Section 7, “Total Energy”).

The 12 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 (2015 forward);
MGCUPZZ	=	motor gasoline sold for construction use in each state, in thousand gallons;
MGIYPZZ	=	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 (2015 forward);
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);
MGMSPZZ	=	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 (2015 forward);
MGSFPZZ	=	special fuels (primarily diesel fuel with small amounts of liquefied petroleum gases) sold in each state, in thousand gallons; and
MGTCPU	=	motor gasoline total consumption in the United States, in thousand barrels.

U.S. totals for the 11 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:

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

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

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

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:

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

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

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

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

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

Total consumption of motor gasoline in each state (MGTCPZZ) is calculated according to each state's share of the total sales:

$$\text{MGTCPZZ} = (\text{MGTPZZ} / \text{MGTPUS}) * \text{MGTCPUS}$$

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

$$\text{MGCCPZZ} = (\text{MGCMPZZ} / \text{MGTPZZ}) * \text{MGTCPZZ}$$

The industrial sector estimated consumption (MGICPZZ) is calculated:

$$\text{MGICPZZ} = (\text{MGINPZZ} / \text{MGTPZZ}) * \text{MGTCPZZ}$$

The transportation sector estimated consumption (MGACPZZ) is calculated:

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

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

British thermal units (Btu)

SEDS uses a national factor, MGTCCKUS, to convert motor gasoline consumption from physical units to British thermal units (Btu) for each state. SEDS uses a constant heat content of 5.253 million Btu per barrel for 1960 through 1992. For 1993 forward, EIA calculates an annual average factor, as shown in Table B1 on page 185, 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 by end-use sector are the sum of the state data.

Additional note

In 2015, the Federal Highway Administration revised its methods of estimating non-highway use of motor gasoline. (See [Off-Highway and Public-Use Gasoline Consumption Estimation Models used in the Federal Highway Administration](#).) Estimates from 2015 forward are not compatible with data before 2015.

Additional calculations

To assist data users in the analysis of consumption of fossil fuel sources and renewable energy sources, SEDS creates a new data series, motor gasoline excluding fuel ethanol (MMTCB), for each state and the United States:

From 1993 forward

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

Before 1993, SEDS assumes that fuel ethanol was not included in the motor gasoline data series (see page 69):

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

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

SEDS only displays the motor gasoline excluding fuel ethanol series in the tables showing primary energy consumption by source. For consumption by end-use sector, SEDS defines motor gasoline as the product consumed by the end users, which includes 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).

MGTCKUS — 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 185). For 1993-

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

MGTCPUS — Motor gasoline total consumption 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

Physical units

The State Energy Data System (SEDS) uses seven data series to estimate the consumption of petroleum coke. Five are measures of petroleum coke consumption and two are indicators of industrial activity used to allocate 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):

PCTCPUS	=	petroleum coke total consumption 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 (PCTCPUS) is the product supplied series from the U.S. Energy Information Administration's (EIA) *Petroleum Supply Annual*.

Information on the amount of petroleum coke consumed for the purpose of generating electricity for the electric power, commercial, and industrial sectors is available from Form EIA-923, "Power Plant Operations Report," and predecessor forms. For the electric power sector (PCEIM), these data are available for 1970 forward. Before 1970, SEDS assumes that consumption is zero. For 1989 forward, electric power sector consumption includes petroleum coke consumed by electric utilities and independent power producers whose primary business is to sell electricity or electricity and heat. SEDS also includes

quantities of petroleum coke used by commercial (PCC3M) and industrial (PCI3M) facilities in combined-heat-and-power units in their respective sectors.

SEDS converts the data for petroleum coke used to generate electricity from thousand short tons to thousand barrels by applying a conversion factor of five barrels per short ton. The U.S. value is the sum of the state data:

PCEIPZZ	=	PCEIMZZ * 5
PCEIPUS	=	ΣPCEIPZZ
PCCCPZZ	=	PCC3MZZ * 5
PCCCPUS	=	ΣPCCCPZZ
PCI3PZZ	=	PCI3MZZ * 5
PCI3PUS	=	ΣPCI3PZZ

SEDS estimates U.S. industrial consumption of petroleum coke by subtracting U.S. electric power and commercial consumption from the total U.S. petroleum coke product supplied:

$$PCICPUS = PCTCPUS - PCEIPUS - PCCCPUS$$

In addition to combined-heat-and-power generation, refineries in the industrial sector use petroleum coke as a catalyst to increase the yield of gasoline from crude oil (catalytic cracking) and for other industrial uses (mainly for conversion into electrodes to produce aluminum).

Through 2012, SEDS calculates state-level estimates of petroleum coke for refinery use 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 is the sum of the states.

$$CTCAPUS = \Sigma CTCAPZZ$$

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 through 2012, 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:

PCRFPZZ	=	PCRFPZZ, or
PCRFPZZ	=	(CTCAPZZ / CTCAPGZ) * PCRFPGZ (1 through 7), or
PCRFPZZ	=	(CTCAPZZ / CTCAPPZ) * PCRFPZ (1 through 5)
PCRFPUS	=	ΣPCRFPZZ

Beginning in 2013, SEDS incorporates unpublished state-level refinery fuel consumption data that satisfy 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. About six to nine states satisfy the disclosure rules and are used directly as state estimates. SEDS subtracts those states from the PAD district data, and allocates the remainders to the remaining states using CTCAPZZ.

SEDS subtracts U.S. petroleum coke used at combined-heat-and-power plants (PCI3PUS) and at refineries (PCRFUS) from the U.S. industrial sector consumption to calculate U.S. consumption of petroleum coke for all other industrial uses:

$$PCOCPUS = PCICPUS - PCI3PUS - PCRFUS$$

SEDS assumes state-level estimates of petroleum coke consumed by other industrial users, mainly aluminum production, are proportional to each state’s aluminum ingot production capacity (AICAPZZ). For 1993 forward, SEDS adjusts state-level aluminum production capacity 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. SEDS calculates the U.S. total as the sum of the states and allocates the other industrial use of petroleum coke to the states as follows:

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

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:

$$PCICPZZ = PCI3PZZ + PCRFZZ + PCOCPZZ$$

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

$$PCTCPZZ = PCCCPZZ + PCICPZZ + PCEIPZZ$$

British thermal units (Btu)

SEDS uses two series to convert petroleum coke from physical unit values to Btu:

$$PCCTKUS = \text{factor for converting catalyst petroleum coke from physical units to Btu; and}$$

$$PCMKKUS = \text{factor for converting marketable petroleum coke from physical units to Btu.}$$

For 2004 forward, PCCTKUS is a constant value of 6.287 million Btu per barrel and PCMKKUS is a constant value of 5.719 million Btu per barrel. For 1960 through 2003, EIA uses a constant factor of 6.024 million Btu per barrel for both series (see Appendix B).

SEDS applies these factors to convert estimated petroleum coke consumption from physical units to Btu by state:

$$\begin{aligned} PCCCBZZ &= PCCCPZZ * PCMKKUS \\ PCI3BZZ &= PCI3PZZ * PCMKKUS \\ PCOCBZZ &= PCOCPZZ * PCMKKUS \\ PCRFBZZ &= PCRFPPZZ * PCCTKUS \\ PCEIBZZ &= PCEIPZZ * PCMKKUS \end{aligned}$$

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

$$PCICBZZ = PCI3BZZ + PCRFBZZ + PCOCBZZ$$

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 note

EIA’s *Petroleum Supply Annual*, and predecessor reports, are the source for petroleum coke used at refineries, PCRFUS and PCRFPGZ. For 1960 through 1980, the source provides the data in thousand short tons. For consistency with later years’ data, SEDS first converts the 1960 through 1980 data into thousand barrels before they are used in SEDS. For 1960 through 1967, the source published data for Texas and New Mexico and for groups of other states. For 1968 through 1980, the source publishes the data for 19 states and combines the remaining states into seven groups. SEDS disaggregates the grouped state data for 1960 through 1967 using the proportions of the 1968 data. For 1981 forward, the source only publishes the data for the PAD districts. For 2013 forward, SEDS incorporates unpublished state-level data that satisfy statistical disclosure rules.

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/petroleum/supply/annual/volume1/>.
- 2005 forward: EIA, *Refinery Capacity Report*, Table 1, <http://www.eia.gov/petroleum/refinerycapacity/>.

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, Form 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).

PCRFPPZ, PCRFPGZ, or PCRFPPZ — 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/petroleum/supply/annual/volume1/>, Table 47.
- 2005 forward: EIA, *Refinery Capacity Report*, Table 12 (2006-2008), Table 12a (2009), and Table 10a (2010 forward), <http://www.eia.gov/petroleum/refinerycapacity/>. 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 consumption 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

The State Energy Data System (SEDS) estimates state-level residual fuel oil consumption for the commercial, industrial, transportation, and electric power sectors. SEDS estimates state-level estimates for the commercial, industrial, and transportation sectors using sales of residual fuel oil into or within each state, published in the U.S. Energy Information Administration's (EIA) *Fuel Oil and Kerosene Sales Report*. SEDS assigns the following variables 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;
- 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.

SEDS uses two other data series to represent residual fuel oil consumption:

- 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.

EIA collects residual fuel oil consumption by the electric power sector (RFEIPZZ) 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 *Petroleum Supply Annual*.

SEDS calculates U.S. totals for all of the data series listed above as the sum of the state data series.

SEDS assigns the sales data series as closely as possible to the end-use sectors used in SEDS. EIA assumes that no residual fuel oil is sold to the residential sector. Residual fuel oil sales to the commercial sector is the RFCMPZZ series.

SEDS calculates state sales of residual fuel oil to the industrial sector, RFINPZZ, as the sum of the residual fuel oil sold for industrial use, including industrial heating and processing (RFIBPZZ), for oil company use (RFOCPZZ), and for all other uses (RFMSPZZ):

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

SEDS calculates state sales of residual fuel oil to the transportation sector, RFTRPZZ, as the sum of the residual fuel oil sales for vessel bunkering (RFBKPZZ), military use (RFMIPZZ), and railroad use (RFRRPZZ):

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

SEDS sums the sales of residual fuel oil to the commercial, industrial, and transportation sectors to create a subtotal of sales to all end-use sectors (RFNDPZZ):

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

SEDS calculates the estimated U.S. residual fuel oil consumption for all end-use sectors (RFNCPUS) by subtracting the total residual fuel oil consumption for the electric power sector from the total U.S. residual fuel oil consumption:

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

SEDS allocates this U.S. subtotal of residual fuel oil consumption for all end-use sectors (RFNCPUS) to the states by using the states' end-use sector sales data. SEDS assumes that each state consumes residual fuel oil in proportion to the amount sold in that state:

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

SEDS estimates state residual fuel oil consumption by sector using the ratio of each sector's sales to the subtotal of all end-use sectors. SEDS calculates the estimated commercial sector consumption in each state, RFCCPZZ, as:

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

SEDS estimates the industrial sector's estimated consumption in each state, RFICPZZ, as:

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

SEDS estimates the transportation sector's estimated consumption in each state, RFACPZZ, as:

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

SEDS estimates U.S. residual fuel oil consumption by the major end-use sectors as the sum of the states' estimated consumption.

SEDS estimates total state residual fuel oil consumption as the sum of all end-use sectors consumption and the electric power sector consumption:

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

British thermal units (Btu)

EIA assumes residual fuel oil has a heat content value of about 6.287 million Btu per barrel. SEDS applies this factor to convert estimated residual fuel oil consumption from physical units to Btu as shown in the following example:

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

SEDS calculates total Btu consumption of residual fuel oil as the sum of the consumption by the end-use sectors and for electricity generation:

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

SEDS calculates the U.S.-level Btu consumption estimates 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, 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.

- 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 78.)
- 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 78.)
- 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 consumption 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

“Other petroleum products” (OP) is the sum of 11 petroleum products. These products, in thousand barrels, are:

- ABTCPUS = aviation gasoline blending components total consumption in the United States;
- COTCPZZ = crude oil (including lease condensate) total consumption in each state;
- FNTCPUS = petrochemical feedstocks, naphtha less than 401°F, total consumption in the United States;
- FOTCPUS = petrochemical feedstocks, other oils equal to or greater than 401°F, total consumption in the United States;
- FSTCPUS = petrochemical feedstocks, still gas, total consumption in the United States (through 1985);
- MBTCPUS = motor gasoline blending components total consumption in the United States;
- MSTCPUS = miscellaneous petroleum products total consumption in the United States;
- SGTCPUS = still gas total consumption in the United States;
- SNTCPUS = special naphthas total consumption in the United States;
- UOTCPUS = unfinished oils total consumption in the United States; and
- WXTCPUS = waxes total consumption in the United States.

The State Energy Data System (SEDS) assumes that all of the products in “other petroleum products” are used by the industrial sector. SEDS creates state estimates 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 before 2001) for the industrial organic chemical manufacturing industry in each state, in million dollars;

- PIVAVZZ = value of shipments (value added before 2001) for the paint and coating manufacturing industry in each state, in million dollars; and
- CGVAVZZ = value of shipments (value added before 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. Before 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

Usually refineries process crude oil to produce petroleum products, but rarely other users use crude oil directly (as energy consumption). Before 1983, The U.S. Energy Information Administration (EIA) reported crude oil burned on leases and by pipelines as fuel as either distillate or residual fuel oil and included it in product supplied for those products. For 1983 through 2009, crude oil used directly in petroleum industry operations was reported as product supplied in the U.S. Energy Information Administration’s (EIA) *Petroleum Supply Annual*. For 2010 forward, EIA assumes that crude oil product supplied, and therefore consumption, is equal to zero.

Physical units

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

$$COTCPUS = \sum COTCPZZ$$

Industrial consumption equals total consumption of crude oil:

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

British thermal units (Btu)

Crude oil has a heat content value of 5.800 million Btu per barrel. SEDS

calculates total Btu consumption and industrial Btu consumption by state and for the United States as:

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

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 through 2009: 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 through 2009: Tables 1, 3, 5, 7, 9, and 11.
- 2010 forward: Zeroes are entered for all years.

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

Physical units

Refineries consume the five petroleum products in this category as fuels.

For 1986 forward, the source reports still gas for petrochemical feedstocks and still gas for other uses together. SEDS estimates state consumption of these products in proportion to each state's crude oil operable capacity at refineries (COCAPZZ). Before 2013, SEDS used operating capacity to allocate consumption. Occasionally, total product supplied for aviation gasoline blending components and unfinished oils is negative. This can occur when such products enter the primary supply channels without reporting their production (e.g., streams returned to refineries from petrochemical plants). SEDS allocates any negative values to the states using the same method. The U.S. total is the sum of the states:

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

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)

SEDS develops Btu estimates for all of the products in this group as the product of the estimated consumption for each individual product, in physical units, by its respective Btu conversion factor. The conversion factors for aviation gasoline blending components, petrochemical feedstocks of still gas, and unfinished oils are constant for all years. Motor gasoline blending components and still gas use different conversion factors, depending on the year. The formulas are:

ABTCBZZ	=	ABTCPZZ * 5.048
ABTCBUS	=	ΣABTCBZZ
ABICBZZ	=	ABTCBZZ
ABICBUS	=	ABTCBUS
FSTCBZZ	=	FSTCPZZ * 6.000
FSTCBUS	=	ΣFSTCBZZ
FSICBZZ	=	FSTCBZZ
FSICBUS	=	FSTCBUS
UOTCBZZ	=	UOTCPZZ * 5.825
UOTCBUS	=	ΣUOTCBZZ
UOICBZZ	=	UOTCBZZ
UOICBUS	=	UOTCBUS

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:

MBTCKUS	=	factor for converting motor gasoline blending components from physical units to Btu.
MBTCBZZ	=	MBTCPZZ * MBTCKUS
MBTCBUS	=	ΣMBTCBZZ
MBICBZZ	=	MBTCBZZ
MBICBUS	=	MBTCBUS

The factor for converting still gas from physical unit values to Btu is fixed at 6.000 million Btu per barrel for 1960 through 2015 and at 6.287 million Btu per barrel for 2016 forward:

SGTCBZZ	=	SGTCPZZ * 6.000 through 2015
SGTCBZZ	=	SGTCPZZ * 6.287 beginning in 2016
SGTCBUS	=	ΣSGTCBZZ
SGICBZZ	=	SGTCBZZ
SGICBUS	=	SGTCBUS

Data sources

ABTCPUS — Aviation gasoline blending components total consumption 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 consumption in the

United States (through 1985).

- 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.

MBTCPUS — Motor gasoline blending components total consumption 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 consumption 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 consumption 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; and petrochemical feedstocks, other oils equal to or greater than 401°F

Physical units

The chemical industry consumes petrochemical feedstocks, naphtha and other oils, to produce petrochemical "building blocks" (such as ethylene) that, in turn, make products such as synthetic fibers, synthetic rubber, and plastics.

The chemical industry produces petrochemicals such as ethylene and propylene by steam cracking. SEDS allocates the U.S. consumption of petrochemical feedstocks to the states using information on nameplate capacity and the share of naphtha and other oils in the feedstock mixture for all steam cracker plants that produce ethylene from various issues of the *Oil and Gas Journal*. For 1997 through 1999, 2002, 2004, 2008, and 2010 through 2014, SEDS uses the capacity data to calculate state shares of steam crackers using naphtha (FNCASZZ) and those using other oils (FOCASZZ). Texas and Louisiana are the only two states that use naphtha and other oils as feedstocks in their steam crackers. SEDS estimates the shares for the interim years using the compound annual growth rates of the years with data. SEDS uses the shares for 1997 for the earlier years.

For 2015 forward, the *Oil and Gas Journal* information is not available. SEDS uses the 2014 values for 2015 forward.

SEDS estimates consumption of petrochemical feedstocks, naphtha less than 401°F, by state and the United States as:

FNTCPZZ = FNTCPUS * FNCASZZ
 FNICPZZ = FNTCPZZ
 FNICPUS = FNTCPUS

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

FOTCPZZ = FOTCPUS * FOCASZZ
 FOICPZZ = FOTCPZZ
 FOICPUS = FOTCPUS

British thermal units (Btu)

SEDS develops Btu estimates for the six petroleum products in this group as the product of each individual product’s estimated consumption, in physical units, by its respective Btu conversion factor. SEDS calculates total Btu consumption and industrial Btu consumption by state and for the United States as:

FNTCBZZ = FNTCPZZ * 5.248
 FNTCBUS = ΣFNTCBZZ
 FNICBZZ = FNTCBZZ
 FNICBUS = FNTCBUS
 FOTCBZZ = FOTCPZZ * 5.825
 FOTCBUS = ΣFOTCBZZ
 FOICBZZ = FOTCBZZ
 FOICBUS = FOTCBUS

Additional note

Before the 2010 cycle, the two 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 more than 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, 2015 forward: EIA estimation, based on data available from the *Oil and Gas Journal*.

FNTCPUS — Petrochemical feedstocks, naphtha less than 401°F, total consumption 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, 2015 forward: 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 consumption 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.

Miscellaneous petroleum products

Physical units

Miscellaneous products include all finished petroleum products not classified elsewhere, such as petrolatum, lube refining byproducts (aromatic extracts and tars), absorption oils, ram-jet fuel, petroleum rocket fuels, synthetic natural gas feed stocks, and specialty oils. EIA assumes that the organic chemical industry consumes most of these products.

SEDS creates state estimates for these products in proportion to the value of shipments (value added before 2001) for the manufacture of industrial organic chemicals in each state (OCVAVZZ).

The U.S. total is the sum of the states:

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

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

$$\text{MSTCPZZ} = (\text{OCVAVZZ} / \text{OCVAVUS}) * \text{MSTCPUS}$$

$$\text{MSICPZZ} = \text{MSTCPZZ}$$

$$\text{MSICPUS} = \text{MSTCPUS}$$

British thermal units (Btu)

EIA uses an average heat content value of 5.796 million Btu per barrel for miscellaneous petroleum products. SEDS calculates total Btu consumption and industrial Btu consumption by state and for the United States as:

$$\text{MSTCBZZ} = \text{MSTCPZZ} * 5.796$$

$$\text{MSTCBUS} = \sum \text{MSTCBZZ}$$

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

$$\text{MSICBZZ} = \text{MSTCBZZ}$$

$$\text{MSICBUS} = \text{MSTCBUS}$$

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 before 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 available at <https://data.census.gov/cedsci/>.
- 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 available at <https://data.census.gov/cedsci/>.

See Additional Note 2 on page 90 for the methodology used to estimated withheld values.

- 2001 through 2005: 2002 *Economic Census*.
- 2006 through 2012: 2007 *Economic Census*.
- 2013 through 2017: 2012 *Economic Census*.
- 2018 forward: 2017 *Economic Census*.

Special naphthas

Physical units

Special naphthas are used as paint and varnish thinners and dry cleaning liquids or solvents. SEDS allocates special naphthas to the states in proportion to the value of shipments (value added before 2001) for the manufacture of paints and allied products in each state (PIVAVZZ).

The U.S. total is the sum of the states:

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

SEDS estimates special naphthas consumption for states and the United States as:

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

British thermal units (Btu)

EIA assumes special naphthas have a heat content value of 5.248 million Btu per barrel. SEDS uses this factor to convert special naphthas estimated consumption from physical units to Btu by state. The U.S. total 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 before 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,” available at <https://data.census.gov/cedsci/>.
- 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 available at <https://data.census.gov/cedsci/>. See Additional Note 2 on page 90 for the methodology used to estimated withheld values.
 - 2001 through 2005: 2002 *Economic Census*.
 - 2006 through 2012: 2007 *Economic Census*.
 - 2013 through 2017: 2012 *Economic Census*.
 - 2018 forward: 2017 *Economic Census*.

SNTCPUS — Special naphthas total consumption 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

Food packaging accounts for more than 50% of petroleum wax consumption in the United States because petroleum waxes are cost-effective moisture and gas barriers. SEDS allocates waxes to the states in proportion to the value of shipments (value added before 2001) for the manufacture of corrugated and solid fiber boxes by state (CGVAVZZ).

The U.S. total is the sum of the states:

$$CGVAVUS = \sum CGVAVZZ$$

SEDS calculates state and U.S. consumption estimates as:

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

British thermal units (Btu)

EIA assumes waxes have a heat content value of 5.537 million Btu per barrel. SEDS uses this factor to convert the estimated consumption of waxes from physical units to Btu by state. The U.S. total is the sum of the states:

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

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 before 2001. Before 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” available at <https://data.census.gov/cedsci/>.
- 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 available at <https://data.census.gov/cedsci/>. See Additional Note 2 on page 90 for the methodology used to estimated withheld values.
 - 2001 through 2005: 2002 *Economic Census*.
 - 2006 through 2012: 2007 *Economic Census*.
 - 2013 through 2017: 2012 *Economic Census*.
 - 2018 forward: 2017 *Economic Census*.

WXTCPUS — Waxes total consumption 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 11 “other petroleum products.” All of these products are consumed by the industrial sector. SEDS calculates state and U.S. industrial use of these other petroleum products as:

$$\begin{aligned} \text{OPICPZZ} &= \text{ABICPZZ} + \text{COICPZZ} + \text{FNICPZZ} + \text{FOICPZZ} + \\ &\quad \text{FSICPZZ} + \text{MBICPZZ} + \text{MSICPZZ} + \text{SGICPZZ} + \\ &\quad \text{SNICPZZ} + \text{UOICPZZ} + \text{WXICPZZ} \\ \text{OPICPUS} &= \sum \text{OPICPZZ} \end{aligned}$$

Total consumption of these products is calculated:

$$\begin{aligned} \text{OPTCPZZ} &= \text{ABTCPZZ} + \text{COTCPZZ} + \text{FNTCPZZ} + \text{FOTCPZZ} + \\ &\quad \text{FSTCPZZ} + \text{MBTCPZZ} + \text{MSTCPZZ} + \text{SGTCPZZ} + \\ &\quad \text{SNTCPZZ} + \text{UOTCPZZ} + \text{WXTCPZZ} \\ \text{OPTCPUS} &= \text{ABTCPUS} + \text{COTCPUS} + \text{FNTCPUS} + \text{FOTCPUS} + \\ &\quad \text{FSTCPUS} + \text{MBTCPUS} + \text{MSTCPUS} + \text{SGTCPUS} + \\ &\quad \text{SNTCPUS} + \text{UOTCPUS} + \text{WXTCPUS} \end{aligned}$$

British thermal units (Btu)

Estimated consumption of all 11 “other petroleum products” in Btu is the sum of the Btu consumption of each product by the industrial sector. SEDS calculates the state and U.S. industrial sector totals as:

$$\begin{aligned} \text{OPICBZZ} &= \text{ABICBZZ} + \text{COICBZZ} + \text{FNICBZZ} + \text{FOICBZZ} + \\ &\quad \text{FSICBZZ} + \text{MBICBZZ} + \text{MSICBZZ} + \text{SGICBZZ} + \\ &\quad \text{SNICBZZ} + \text{UOICBZZ} + \text{WXICBZZ} \\ \text{OPICBUS} &= \sum \text{OPICBZZ} \end{aligned}$$

SEDS calculates state and U.S. total consumption of these products as:

$$\begin{aligned} \text{OPTCBZZ} &= \text{ABTCBZZ} + \text{COTCBZZ} + \text{FNTCBZZ} + \text{FOTCBZZ} + \\ &\quad \text{FSTCBZZ} + \text{MBTCBZZ} + \text{MSTCBZZ} + \text{SGTCBZZ} + \\ &\quad \text{SNTCBZZ} + \text{UOTCBZZ} + \text{WXTCBZZ} \\ \text{OPTCBUS} &= \sum \text{OPTCBZZ} \end{aligned}$$

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* (through 1992) or *Economic Census* (for 1997 forward). For individual industry series, some state-level data are withheld from publication to avoid disclosing operations of individual companies. Before 1992, the total withheld data was apportioned to the withheld states on the basis of those states’ proportional values in the previous census. For 1992 forward, the total withheld value was apportioned to states with withheld data in proportion to the number of employees in that industry in each state.
2. In 1982, all respondents to the *Census of Manufactures* survey were requested to report their inventories at cost or market before 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. So, data for value added by manufacture after 1982 are not comparable to the prior years’ data.

Petroleum Aggregates

The State Energy Data System (SEDS) estimates total petroleum product consumption by sector as the sum of all individual products by sector. Table TN4.1 indicates which petroleum products are consumed in each sector. SEDS describes how it estimates consumption of each individual petroleum product in the subsections that proceed this one.

Residential sector

Petroleum products consumed by the residential sector are: distillate fuel oil (DF); kerosene (KS); and hydrocarbon gas liquids (HL). For the residential sector, the state and U.S. totals in physical units are:

$$\begin{aligned} \text{PARCPZZ} &= \text{DFRCPZZ} + \text{HLRCPZZ} + \text{KSRCPPZ} \\ \text{PARCPUS} &= \Sigma \text{PARCPZZ} \end{aligned}$$

State and U.S. totals in Btu are:

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

Commercial sector

Petroleum products consumed by the commercial sector are: distillate fuel oil (DF); kerosene (KS); hydrocarbon gas liquids (HL); motor gasoline (MG); and residual fuel oil (RF). In physical units, the state and the U.S. totals for the commercial sector are:

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

State and U.S. totals in Btu are:

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

Industrial sector

Petroleum products consumed by the industrial sector are: asphalt and road oil (AR); distillate fuel oil (DF); kerosene (KS); hydrocarbon gas liquids (HL); lubricants (LU); motor gasoline (MG); petroleum coke (PC); residual fuel oil (RF); and the 11 products that are already summed in the "other petroleum products" (OP) subtotal. The state and U.S. total estimates in physical units are:

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

State and U.S. totals in Btu are:

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

Transportation sector

Petroleum products consumed by the transportation sector are: aviation gasoline (AV); distillate fuel oil (DF); jet fuel (JF); hydrocarbon gas liquids (HL); lubricants (LU); motor gasoline (MG); and residual fuel oil (RF). The state and U.S. totals in physical units are:

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

State and U.S. totals in Btu are:

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

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:

$$\begin{aligned} \text{PATCPZZ} &= \text{ARTCPZZ} + \text{AVTCPZZ} + \text{DFTCPZZ} + \text{HLTCPZZ} + \\ &\quad \text{JFTCPZZ} + \text{KSTCPZZ} + \text{LUTCPZZ} + \text{MGTCPZZ} + \\ &\quad \text{OPTCPZZ} + \text{PCTCPZZ} + \text{RFTCPZZ} \\ \text{PATCPUS} &= \text{ARTCPUS} + \text{AVTCPUS} + \text{DFTCPUS} + \text{HLTCPUS} + \\ &\quad \text{JFTCPUS} + \text{KSTCPUS} + \text{LUTCPUS} + \text{MGTCPUS} + \\ &\quad \text{OPTCPUS} + \text{PCTCPUS} + \text{RFTCPUS} \end{aligned}$$

State and U.S. totals in Btu are:

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

Total consumption of petroleum products per capita

SEDS calculates total consumption of all petroleum products per capita by dividing total petroleum product consumption by resident population (“TPOPP”). See Appendix C of the Consumption Technical Notes at <https://www.eia.gov/state/seds/seds-technical-notes-complete.php>.

SEDS calculates estimated total consumption of petroleum products per capita for each state and the United States, in barrels, (PATPP) as:

$$\text{PATPP} = \text{PATCP} / \text{TPOPP}$$

SEDS calculates estimated total consumption of petroleum products per capita for each state and the United States, in million Btu, (PATPB) as:

$$\text{PATPB} = \text{PATCB} / \text{TPOPP}$$

Additional calculations

SEDS combines a few petroleum products displayed 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, petroleum coke, and the 11 petroleum products described in the “other petroleum products” section of the Technical Notes. SEDS calculates the variables in physical units and Btu, for each state and the United States:

$$\begin{aligned} \text{P1TCP} &= \text{ARTCP} + \text{AVTCP} + \text{KSTCP} + \text{LUTCP} + \text{OPTCP} + \text{PCTCP} \\ \text{P1TCB} &= \text{ARTCB} + \text{AVTCB} + \text{KSTCB} + \text{LUTCB} + \text{OPTCB} + \text{PCTCB} \\ \text{P1ICP} &= \text{ARICP} + \text{KSICP} + \text{LUICP} + \text{OPICP} + \text{PCICP} \\ \text{P1ICB} &= \text{ARICB} + \text{KSICB} + \text{LUICB} + \text{OPICB} + \text{PCICB} \end{aligned}$$

Total petroleum data usually include the volumes of fuel ethanol and biodiesel blended with motor gasoline and distillate fuel oil, respectively. To assist data users in the analysis of consumption of renewable energy sources, which include fuel ethanol and biodiesel, versus consumption of fossil fuels, SEDS calculates a data series, “total petroleum excluding biofuels” (PMTCB), for each state and the United States:

$$\begin{aligned} \text{PMTCB} &= \text{ARTCB} + \text{AVTCB} + \text{DMTCB} + \text{HLTCB} + \text{JFTCB} + \\ &\quad \text{KSTCB} + \text{LUTCB} + \text{MMTCB} + \text{OPTCB} + \text{PCTCB} + \text{RFTCB} \end{aligned}$$

SEDS uses a data series called “total petroleum excluding biofuels” in the tables that show primary energy consumption by source. For consumption by end-use sector, total petroleum estimates include the volumes of fuel ethanol and biodiesel consumed in motor gasoline and distillate fuel oil, as they are consumed by the end users.

The U.S. Energy Information Administration’s (EIA) *Monthly Energy Review* publishes conversion factors for all petroleum products consumed by each sector, as well as for the combined residential and commercial sectors.

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

SEDS calculates consumption of all petroleum products by the combined residential and commercial sectors, in physical units, in Btu, and the average conversion factor as:

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

PAHCKUS = PAHCBUS / PAHCPUS