State Energy Data System 2023 Production Technical Notes

Contents

Introduction

The U.S. Energy Information Administration's (EIA) State Energy Data System (SEDS) provides Members of Congress, federal and state agencies, and the general public with comparable state-level data on energy production, consumption, prices, expenditures, indicators, and carbon dioxide emissions from energy consumption. The SEDS energy production database provides annual time series of the production of primary energy sources by state, generally for 1960 forward. EIA's Office of Energy Demand and Integrated Statistics compiles data from information collected by EIA (and its predecessor agencies) and other publicly available sources.

Purpose

Various EIA surveys collect energy production data in physical units and publish the data in reports on the EIA website. However, most EIA data are published only for the latest time period or for a shorter time series and do not include earlier historical data. Also, it is not possible to compare production across fuels that are reported in different physical units or to calculate total energy production. The SEDS energy production database converts physical unit production into common units of heat, called British thermal units (Btu), and provides a standardized set of state energy production data for comparisons over time, across fuels, and across states.

Coverage

The primary energy sources used to calculate total energy production in the state energy production database include:

- Coal
- Crude oil
- Natural gas, marketed production[1]
- Nuclear electric power
- Renewable energy

Production data for coal, crude oil, and natural gas come from EIA sources and earlier reports published by other agencies. SEDS converts the production data from physical units (short tons, barrels, and cubic feet) to British thermal units (Btu) using estimated heat content conversion factors. The EIA heat content per unit of physical unit (thermal conversion factors) represents the gross (or higher or upper) energy content of the fuel.

Nuclear electric power production in Btu, which also equals consumption, is the nuclear electricity net generation multiplied by the average heat rate of the nuclear power plants.

Renewable energy includes biofuels, geothermal, hydroelectric power, solar, wind, wood, and biomass waste. Biofuels include fuel ethanol, biodiesel, renewable diesel, and other biofuels. SEDS estimates state-level production of fuel ethanol, biodiesel, and renewable diesel in thousand barrels, using data provided by some states and plant capacity data. SEDS estimates US-level production only for other biofuels. SEDS defines biofuel production in Btu as the total heat content of biomass inputs (or feedstock such as corn and soy) used in the production of fuel ethanol and biodiesel (including losses and co-products), plus the heat content of pure renewable diesel and other biofuels liquid fuel production. SEDS assumes that production of other renewable energy equals consumption, except for wood production for 2016 forward. See Section 5 for the description of renewable energy concepts and estimation procedures.

To avoid double-counting, production (generation) of electricity, a secondary energy source, is not covered in this report (see the EIA Electricity Data Browser for state electricity generation data). SEDS counts production of domestically produced fossil fuels used for electricity generation as production in the producing state. For example, SEDS counts coal production in the state that the mine is located, even if the coal is transported to another state to generate electricity). SEDS counts production of nuclear fuels and renewable energy used for electricity generation as production in the electricity generating state.

[1] SEDS presents marketed production for natural gas, in contrast to the *Monthly Energy Review*, EIA's national energy publication, which presents production data for dry natural gas and natural gas plant liquids. See discussion in Section 3.

Sections 1 through 5 of this documentation describe the data sources and the estimation methodologies used to derive the production series for each energy source.

Comparability

To maintain internal consistency, SEDS calculates U.S. estimates as the sum of all states, District of Columbia, and federal offshore production, if any, except for other biofuels and aggregate categories that include other biofuels, because SEDS only estimates U.S.-level data for other biofuels and not state-level data. U.S. totals may not exactly equal the national data published in other EIA publications because of rounding or differences in estimation methods. The box below summarizes the differences between the U.S. production estimates in SEDS and the U.S. production data published in the *Monthly Energy Review* (MER).

Differences between U.S. production estimates in SEDS and MER

EIA's *Monthly Energy Review* (MER) and SEDS publish annual time series of production data at the U.S. level in both physical units and Btu. The differences between the physical unit production data in SEDS and MER are minor and mostly because of rounding. Because SEDS computes the Btu production of coal and natural gas using state-level conversion factors, instead of a U.S.-level factor as the MER does, the differences between the U.S. Btu production data are more noticeable for those fuels.

Coal

Using the state-level conversion factors from EIA's Office of Energy Production, Conversion, and Delivery, SEDS U.S. coal production estimates in Btu are usually within 1% of the MER estimates. For 1989 forward, the MER's coal production in Btu also includes waste coal supplied, which is not included in the SEDS estimates.

Crude oil

There is no noticeable difference in the crude oil production data presented in SEDS and MER.

Natural gas

SEDS uses state-level thermal conversion factors for dry natural gas and regional-level thermal conversion factors for natural gas plant liquids to calculate natural gas marketed production in Btu. In contrast, MER uses U.S.-level thermal conversion for dry natural gas and natural gas plant liquids. The differences between the SEDS U.S. series and the sum of the two MER series are less than 0.5% in most years. The maximum difference is 2.1% in 1997. No attempt has been made to reconcile the two sets of estimates.

Nuclear energy

The SEDS and MER U.S. production estimates are the same for nuclear-generated power.

Renewable energy

The SEDS and MER U.S. production estimates are the same for all renewable energy sources.

Total energy

The SEDS and MER U.S. production estimates are the same for all total energy sources.

Section 1. Coal

EIA collects annual coal production in short tons from U.S. coal producers on Form EIA-7A, "Annual Survey of Coal Production and Preparation" and its predecessor forms. State production data are available in the *Annual Coal Report* and its predecessor publications as described under Sources below. EIA's Office of Energy Production, Conversion, and Delivery (EPCD) provides the state data used in SEDS. Beginning in 2001, the coal production data also include a small volume of refuse recovery coal. SEDS allocates the refuse coal production to the states where the mines are located. SEDS excludes waste coal from its production estimates.

EPCD also develops the state-level thermal conversion factors, in Btu per pound. For all years, the conversion factors are the heat contents of coal delivered to electric power plants (reported on Form EIA-923, "Power Plant Operations Report" and predecessor forms). EPCD assumes that the 1960 through 1971 factors are the same as the 1972 factors. For states that have a significant amount of their coal consumed in coke plants, other manufacturing industries, or exported, EPCD adjusts the conversion factors to reflect a higher heat content of coal produced for such uses. Consequently, the resultant U.S.-level Btu production estimates for the earlier years deviate more from the MER, which uses a U.S.-level average thermal conversion factor.

Variable names and definitions

The independent data series identifying codes for coal data are: ("ZZ" represents the two-letter state code in the variable names):

CLPRPZZ = coal production, in thousand short tons, by state; and
CLPRKZZ = factor for converting coal production from physical units to Btu, by state.

SEDS calculates coal production in billion Btu using the following formula:

CLPRBZZ = CLPRPZZ * CLPRKZZ

SEDS calculates the U.S. total coal production, CLPRPUS and CLPRBUS, as the sum of the states' values:

CLPRPUS = ΣCLPRPZZ
CLPRBUS = ΣCLPRBZZ

The average thermal conversion factor for the U.S. total is:

CLPRKUS = CLPRBUS / CLPRPUS

Data sources

CLPRPZZ — Coal production, in thousand short tons, by state.

- 1960 through 1975: Bureau of Mines, *Minerals Yearbook*, "Coal—Bituminous and Lignite" and "Coal—Pennsylvania Anthracite" chapters.
- 1976: U.S. Energy Information Administration (EIA), *Energy Data Reports*, "Coal—Bituminous and Lignite in 1976" and "Coal—Pennsylvania Anthracite 1976."
- 1977 and 1978: EIA, *Energy Data Reports*, "Bituminous Coal and Lignite Production and Mine Operations," "Coal—Pennsylvania Anthracite" and "Coal Production," annual reports.
- 1979 and 1980: EIA, *Energy Data Reports*, "Weekly Coal Report and Coal Production," annual reports.
- 1981 through 1988: EIA, *Weekly Coal Production and Coal Production*, annual reports.
- 1989 through 2000: EIA, *Coal Industry Annual*, annual reports, Table 1.
- 2001 forward: EIA, *Annual Coal Report*, annual reports, Table 1.

CLPRKZZ — Factor for converting coal production from physical units to Btu, by state.

- 1960 through 1971: No data available. Estimated using 1972 factors and adjusting for products with higher heat content.
- 1972 through 1988: Based on Federal Energy Regulatory Commission, Form FERC-423, “Monthly Report of Cost and Quality of Fuels for Electric Plants.”
- 1989 forward: Based on Forms FERC-423, “Monthly Report of Cost and Quality of Fuels for Electric Plants,“ (1989-2001), EIA-423, “Monthly Cost and Quality of Fuels for Electric Plants Report,” (2002-2007), and EIA-923, “Power Plant Operations Report,” (2008 forward) (https://www.eia.gov/electricity/data/eia923/) and Platts COALdat database.

Section 2. Crude oil

EIA's Office of Energy Production, Conversion, and Delivery (EPCD) compiles production of crude oil (including lease condensate) in thousand barrels. Before 1976, the U.S. Department of the Interior, Bureau of Mines, compiled the data. For 1981 forward, annual state-level data are from EIA, Petroleum Data, Crude Oil Production. Before 1981, the data are from the publications described in the sources below.

Before 2015, EIA converted crude oil production data in thousand barrels to billion Btu using a fixed conversion factor of 5.8 million Btu per barrel. For 2015 forward, EIA calculates the crude oil thermal conversion factors using gravity ranges of crude oil production data from the American Petroleum Institute (API).

Federal offshore production

For 1981 forward, the EIA data source provides federal offshore crude oil production data in the Petroleum Administration for Defense District (PADD) 3 (Gulf Coast) and PADD 5 (West Coast) regions. Before 1981, the source data included federal offshore crude oil production in the Gulf Coast region with Alabama, Louisiana, and Texas, and that in the West Coast region with California.

For 1960 through 1981, to maintain compatibility of state-level production over time, SEDS assigns U.S. Department of the Interior crude oil production from the Gulf of America (GOA) Planning Areas to PADD 3 and production from the Federal Pacific Offshore area to PADD 5. SEDS removes the Central GOA production from Louisiana, Western GOA production from Texas, Eastern GOA production from Alabama, and the Pacific production from California.

Variable names and definitions

The independent data series identifying codes for crude oil data are ("ZZ" represents the two-letter state code or federal offshore region in the variable names):

PAPRPZZ = crude oil production (including lease condensate), in thousand barrels, by state or federal offshore region; and

COPRKUS = factor for converting crude oil production from physical units to Btu for the United States.

SEDS calculates crude oil production (including lease condensate) in billion Btu using the following formula:

PAPRBZZ = PAPRPZZ * COPRKUS

The U.S. total crude oil production (including lease condensate), PAPRPUS and PAPRBUS, is the sum of the states and federal offshore regions:

PAPRPUS = ΣPAPRPZZ

PAPRBUS = ΣPAPRBZZ

Data sources

PAPRPZZ — Crude oil production (including lease condensate), in thousand barrels, by state or federal offshore region.

- 1960 through 1965: U.S. Department of the Interior, Bureau of Mines, *Crude Petroleum and Petroleum Products*, Table 5, "Production of Crude Petroleum in the United States."
- 1966: U.S. Department of the Interior, Bureau of Mines, *Crude Petroleum, Petroleum Products and Natural Gas Liquids*, Table 5, "Production of Crude Petroleum in the United States."
- 1967 through 1980: EIA, Energy Data Reports, *Crude Petroleum, Petroleum Products and Natural Gas Liquids*, Table 5, "Production of Crude Petroleum (including Lease Condensate) by PAD District and

State."

- 1960 through 1980: U.S. Department of the Interior, Bureau of Ocean Energy Management (Gulf of America Planning Areas) and Bureau of Safety and Environmental Enforcement (Pacific OCS Region).
- 1981 forward: EIA *Petroleum Supply Annual*, table on "Production of Crude Oil by PAD District and State," also available at https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm.

COPRKUS — Factor for converting crude oil production from physical units to Btu for the United States.

- 1960 through 2014: EIA, *Monthly Energy Review*, Table A2. EIA adopted the thermal conversion factor of 5.8 million Btu per barrel as reported in a Bureau of Mines internal memorandum, "Bureau of Mines Standard Average Heating Values of Various Fuels, Adopted January 3, 1950."
- 2015 forward: EIA, *Monthly Energy Review*, Table A2. Based on conversion of American Petroleum Institute (API) gravity ranges of crude oil production as reported on Form EIA-914, "Monthly Crude Oil, Lease Condensate, and Natural Gas Production Report."

Section 3. Natural gas (marketed production)

EIA's Office of Energy Production, Conversion, and Delivery (EPCD) collects and compiles natural gas production data in cubic feet.

There are different ways to measure natural gas production, because natural gas goes through many stages of processing. SEDS publishes data for marketed natural gas production. Gross withdrawals cover the full well stream volume extracted from oil and natural gas wells. Marketed production is gross withdrawals minus gas used for repressuring, venting and flaring, and nonhydrocarbon gases removed in treating and processing operations. Dry natural gas production is the product that is ready for pipeline transmission and distribution. Natural gas processing plants also separate some gross withdrawals as liquids (called natural gas plant liquids, or NGPLs) from the marketed gas stream. EIA reports NGPLs in gallons, barrels, and cubic feet. The cubic feet volume of NGPL extracted (previously known as extraction loss) is called NGPL production, gaseous equivalent. For more information on natural gas terms and definitions, sources, and explanatory notes see: https://www.eia.gov/dnav/ng/TblDefs/ng_prod_sum_tbldef2.asp.

SEDS uses the concept of marketed production, in contrast to EIA's *Monthly Energy Review* (MER), which presents production of dry natural gas and NGPL separately. MER considers liquids extracted from natural gas production to be petroleum products, and MER's national NGPL production data come from EIA's petroleum surveys. MER calculates the Btu content of NGPL using the weighted thermal conversion factors for each NGPL component by its national production volume. SEDS does not use this method because production data for the NGPL components are not available at the state level. Instead, SEDS publishes state-level data for natural gas marketed production, which is the sum of dry natural gas and NGPL production, gaseous equivalent.

SEDS uses state-level thermal conversion factors of natural gas delivered to consumers to convert dry natural gas production data from cubic feet to Btu. For NGPL, SEDS uses regional-level thermal conversion factors, weighted by the production volume of each NGPL component, to convert state-level NGPL production data from cubic feet to Btu. State-level marketed production is the sum of the two estimates.

Dry production

For 1982 forward, annual state-level dry natural gas production data are from EIA, Natural Gas Data, Gross Withdrawals and Production, Dry Production table. For 1970 through 1981, the data are from EIA, *Historical Natural Gas Annual 1930 Through 2000*.

Federal offshore production

For 1997 forward, EIA publishes federal offshore production in the Gulf of America (GOA). Before 1997, the sources include GOA federal offshore production (formerly labeled as Gulf of Mexico data) with Alabama, Louisiana, and Texas. Before 1997, to maintain compatibility of state-level production over time, SEDS assigns federal offshore GOA production using EIA marketed production for Federal Offshore Gulf of America (1992-1996), EIA gross withdrawals for Federal Offshore GOA (1967-1991), and U.S. Department of the Interior Outer Continental Shelf (OCS) total gas production for the GOA Planning Areas (1970-1977). SEDS removes Eastern GOA production from Alabama, Central GOA production from Louisiana, and Western GOA production from Texas.

For all years, SEDS includes Alaska offshore production in and California offshore production to those states, as reported by EIA.

Conversion factors

EPCD compiles state-level thermal conversion factors for natural gas delivered to consumers (NGTCK). For all states, SEDS assumes that conversion factors for dry natural gas production are equal to those for natural gas delivered to consumers. SEDS uses the NGTCK factors to convert dry production of natural gas from million cubic feet to billion Btu, which are available at https://www.eia.gov/state/seds/sep_use/total/csv/use_convfac.csv.

For federal offshore production, SEDS calculates average conversion factors for dry natural gas using the

conversion factors of Alabama, Louisiana, and Texas, weighted by the production shares of the Eastern, Central, and Western GOA Planning Areas from the U.S. Department of the Interior.

NGPL production, gaseous equivalent

For 1970 forward, annual state-level NGPL production, gaseous equivalent, data are from EIA, Natural Gas Data, Gross Withdrawals and Production, NGPL Production, Gaseous Equivalent table. For 2012 forward, the source reports NGPL production, gaseous equivalent, for the GOA federal offshore production. Before 2012, the source allocated the production to the states that processed the GOA natural gas. No attempt was made to adjust the change in classification.

Conversion factors

The products covered in NGPL, such as propane and ethane, have different thermal conversion factors, and no state-level production data for the individual products are available from the natural gas surveys. However, EIA collects production data in barrels for each NGPL product in its petroleum surveys and publishes the data for the Petroleum Administration for Defense District (PADD) refining districts.[1] SEDS derives the thermal conversion factors for NGPL production, gaseous equivalent, in a multi-step process.

First, SEDS calculates production-weighted averages for NPGL using the thermal conversion factors of the five major products comprising NGPL at the PADD refining district level. The thermal conversion factors for the five NGPL products in million Btu per barrel are:

Ethane	2.783
Propane	3.841
Butane	4.353
Isobutane	4.183
Natural gasoline	4.638

Then, SEDS converts the PADD refining district factors from million Btu per barrel to thousand Btu per cubic foot, using an annual ratio of U.S. total NGPL production in thousand barrels from the petroleum surveys and U.S. total NGPL production (gaseous equivalent) in million cubic feet from the natural gas surveys. SEDS then applies the district-level thermal conversion factors to the NGPL production, gaseous equivalent, for each state in the district to calculate the Btu estimates.

Marketed production

For 1970 forward, marketed natural gas production, in cubic feet and Btu, is the sum of dry natural gas production and NGPL production.

For 1960 through 1969, marketed natural gas production data in cubic feet are from the *Minerals Yearbook* published by the U.S. Department of the Interior Bureau of Mines. SEDS converts the data to Btu using the 1970 derived state-level marketed production thermal conversion factors.

Federal offshore production

For 1960 through 1969, SEDS assigns U.S. Department of the Interior federal offshore marketed production for the Gulf of America (GOA) Planning Areas. SEDS removes Eastern GOA production from Alabama, Central GOA production from Louisiana, and Western GOA production from Texas.

Variable names and definitions

For 1970 forward, the independent data series identifying codes for natural gas data are ("ZZ" represents the two-letter state code in the variable names):

[2] For a description and maps of PADD refinery districts, see Appendix A of *Petroleum Supply Monthly*.

NGPRPZZ = natural gas dry production, in million cubic feet, by state or federal offshore GOA;
NGPRKZZ = factor for converting dry natural gas production from million cubic feet to billion Btu, by state or federal offshore GOA;
NGELPZZ = NGPL production, gaseous equivalent, in million cubic feet, by state; and
NGELKZZ = factor for converting NGPL production, gaseous equivalent, from physical units to Btu, by state.

SEDS calculates dry natural gas production and NGPL production in Btu as:

NGPRBZZ = NGPRPZZ * NGPRKZZ
NGELBZZ = NGELPZZ * NGELKZZ

Marketed production is the sum of dry natural gas production and NGPL production:

NGMPPZZ = natural gas marketed production, in million cubic feet, by state
= NGPRPZZ + NGELPZZ
NGMPBZZ = natural gas marketed production, in billion Btu, by state
= NGPRBZZ + NGELBZZ
NGMPKZZ = factor for converting marketed natural gas production from physical units to Btu, by state
= NGMPBZZ / NGMPPZZ

For 1960 through 1969, the independent data series is:

NGMPPZZ = natural gas marketed production, in million cubic feet, by state.

SEDS estimates the Btu content of marketed production using the 1970 state-level thermal conversion factors:

NGMPBZZ = NGMPPZZ * 1970's NGMPKZZ

The U.S. marketed production, NGMPPUS and NGMPBUS, is the sum of the states and federal offshore GOA:

NGMPPUS = ΣNGMPPZZ
NGMPBUS = ΣNGMPBZZ

SEDS derives the U.S. conversion factor, NGMPKUS, using the same formula for the states:

NGMPKUS = NGMPBUS / NGMPPUS

Additional note

Because of the complexity in accounting for interstate flow of "raw" (unprocessed) natural gas, there are a few cases in which NGPL production is greater than marketed production at the state level. Most of the cases are in Illinois in the early years. For these cases, SEDS uses a simple average of the thermal conversion factors for dry natural gas and NGPL for the specific state and year to convert the marketed production from cubic feet to Btu.

Data sources

NGPRPZZ — Natural gas dry production, in million cubic feet, by state or federal offshore GOA.

- 1970 through 2000: EIA, *Historical Natural Gas Annual 1930 Through 2000*. Sources for the data are:
  - 1970 through 1975: Data are based on reports received from state agencies' responses to informal data requests and the United States Geological Survey (USGS).
  - 1980 through 1981: EIA, Form EIA-627, "Annual Quantity and Value of Natural Gas Report," and the USGS.
  - 1982 through 1995: EIA, Form EIA-627, and the United States Minerals Management Service; West Virginia.
  - 1995: EIA, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1996 Annual Report, DOE/EIA-0216(96); and EIA computations.

  - 1996 through 2000: Form EIA-895, "Monthly Quantity and Value of Natural Gas Report;" and the U.S. Minerals Management Service; West Virginia, 2000: EIA, *U.S. Crude Oil, Natural Gas and Natural Gas Liquids Reserves, Annual Reports*, DOE/EIA-0216.
- 1970 through 1997: Sources for GOA federal offshore production are:
  - 1970 through 1976: U.S. Department of the Interior, Bureau of Ocean Energy Management.
  - 1977 through 1991: EIA, Natural Gas Data, Offshore Gross Withdrawals.
  - 1992 through 1996: EIA, Natural Gas Data, Marketed Production.
- 2001 forward: EIA, *Natural Gas Annual*, state summaries. Also available from Natural Gas Data Production, Gross Withdrawals and Production, Dry Production tables (including revised data for earlier years). Sources for the NGA data are: Form EIA-895, "Monthly Quantity and Value of Natural Gas Report;" and the U.S. Minerals Management Service; West Virginia, 2000: EIA, *U.S. Crude Oil, Natural Gas and Natural Gas Liquids Reserves, Annual Reports*, DOE/EIA-0216.

NGELPZZ — NGPL production, gaseous equivalent, in million cubic feet, by state.

- 1970 through 2000: EIA, *Historical Natural Gas Annual 1930 Through 2000*. Sources for the data are:
  - 1970 through 1975: Data are based on reports received from state agencies' responses to informal data requests and the United States Geological Survey (USGS).
  - 1980 through 1981: EIA, Form EIA-627, "Annual Quantity and Value of Natural Gas Report," and the USGS.
  - 1982 through 1995: EIA, Form EIA-627, and the United States Minerals Management Service; West Virginia.
  - 1995: EIA, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1996 Annual Report, DOE/EIA-0216(96); and EIA computations.
  - 1996 through 2000: Form EIA-895, "Monthly Quantity and Value of Natural Gas Report;" and the U.S. Minerals Management Service; West Virginia, 2000: EIA, *U.S. Crude Oil, Natural Gas and Natural Gas Liquids Reserves, Annual Reports*, DOE/EIA-0216.
- 2001 forward: EIA, *Natural Gas Annual*, state summaries. Also available from Natural Gas Data Production, Natural Gas Plant Processing, NGPL Production, Gaseous Equivalent tables (including revised data for earlier years). Sources for the NGA data are: Form EIA-895, "Monthly Quantity and Value of Natural Gas Report;" and the U.S. Minerals Management Service; West Virginia, 2000: EIA, *U.S. Crude Oil, Natural Gas and Natural Gas Liquids Reserves, Annual Reports*, DOE/EIA-0216.

NGMPPZZ — Natural gas marketed production, in million cubic feet, by state.

- 1960 through 1969: U.S. Department of the Interior, Bureau of Mines, *Minerals Yearbook*.
- 1960 through 1969: U.S. Department of the Interior, Bureau of Ocean Energy Management (GOA federal offshore production).

NGPRKZZ — Factor for converting dry natural gas production from million cubic feet to billion Btu, by state and federal offshore.

- For states, assumed by EIA to be equal to the thermal conversion factor for dry natural gas consumption (NGTCKZZ).
  - 1970 through 1979: EIA adopted the thermal conversion factors calculated annually by the American Gas Association and published in *Gas Facts*.
  - 1980 through 1996: EIA, *Historical Natural Gas Annual 1930 Through 2000*, Table 16.
  - 1997 forward: EIA, *Natural Gas Annual*, Table 16, and unpublished revisions.
- For federal offshore, assumed by EIA to be equal to the average thermal conversion factors for dry natural gas using the conversion factors of Alabama, Louisiana, and Texas, weighted by the production shares of the Eastern, Central, and Western GOA Planning Areas from the U.S. Department of the Interior.
  - 1960 forward: U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM), https://www.data.boem.gov/Production/ProdbyPlanArea/Default.aspx.

Section 4. Nuclear energy

Electric power plants use nuclear energy to generate electricity. SEDS assumes nuclear energy production equals consumption.

Nuclear energy consumption in Btu is the product of nuclear electricity net generation and the average heat rate of the nuclear power plants. The definition, data sources, and estimation methodology are described in Section 6: Electricity, SEDS consumption technical notes.

SEDS uses the state-level consumption estimates (equal to net generation) in thousand kilowatthours and consumption estimates in billion Btu from the SEDS consumption database for production.

Variable name and definition

The independent data series identifying codes for nuclear energy data are ("ZZ" represents the two-letter state code in the variable names):

NUEGPZZ = nuclear electricity net generation in the electric power sector, in million kilowatthours, by state; and
NUETBZZ = nuclear energy consumed for electricity generation, total, in billion Btu, by state.

Data source

Physical unit consumption estimates from SEDS are available in comma-separated value (CSV) format: https://www.eia.gov/state/seds/sep_use/total/csv/use_all_phy.csv.

Btu consumption estimates from SEDS are available in CSV format: https://www.eia.gov/state/seds/sep_use/total/csv/use_all_btu.csv.

Additional note

Data for electric power generation are net generation data. Negative generation denotes that electric power consumed for plant use exceeds gross generation. A few such cases can be found in electric power generated by nuclear power plants.

Section 5. Renewable energy

Renewable energy production in SEDS includes biofuels (biodiesel, fuel ethanol, renewable diesel, and other biofuels), wood and waste, and noncombustible renewable energy sources (hydroelectric power, and geothermal, solar, and wind energy).

Biofuels

SEDS estimates annual state-level production for three biofuels: biodiesel, fuel ethanol, and renewable diesel. SEDS estimates annual US-level production for other biofuels. SEDS also estimates the losses and co-products[1] associated with biodiesel and fuel ethanol separately.

Biodiesel

Production in physical units

For 2001 forward, EIA publishes U.S.-level biodiesel production data in the *Monthly Energy Review* (MER) and SEDS estimates state-level biodiesel production. When available, SEDS uses state reported biodiesel production data. For states without reported data, SEDS estimates state-level biodiesel production using data from EIA's *Monthly Biodiesel Production Report* and other sources.

Some states publish biodiesel production data for some years. These states include Iowa (2005 forward), Michigan (2018), Minnesota (2005-2009 and 2012-2016, with 2010 and 2011 assumed to equal the 2012 value), Montana (2016 forward), North Dakota (2016 and 2018 forward), and Virginia (2008 forward).

For 2009 forward, SEDS uses published and unpublished data from EIA Form EIA-22M, "Monthly Biodiesel Production Survey" (2009 through 2020) and Form EIA-819, "Monthly Report of Biofuels, Fuels from Non-Biogenic Wastes, Fuel Oxygenates, Isooctane, and Isooctene" (2021 forward) to estimate production of the states with no published data. The *Monthly Biodiesel Production Report*, generated from the survey, publishes production data by Petroleum Administration for Defense District (PADD) and capacity data by state for 2009 forward. Because of the volatility of biodiesel production, instead of nameplate capacity, SEDS uses unpublished monthly data on plant-level operating status to compute an annual average "operating capacity" for each plant and aggregate them to the state level. SEDS uses operating capacity data for 2014 for 2013. To estimate missing state production, SEDS subtracts the available state biodiesel production data from the total production of the corresponding PADD and allocates the remainder to the other states in the PADD using the share of the state's operating capacity.

For 2001 through 2008, PADD-level production data do not exist and nameplate capacity data are sporadic. SEDS uses the reported production data from specific states and estimates the rest as follows. First, SEDS computes a set of operating capacity estimates by state for 2001 through 2008 using the 2009 operating capacity data and information on start date and capacity expansion for individual plants. Then, SEDS subtracts the available state biodiesel production data from the U.S. total and allocates the remainder to the other states proportionally to the share of the state's operating capacity.

Heat content of biomass inputs to the production of biodiesel

To convert biodiesel production to British thermal units (Btu), SEDS uses EIA's biodiesel thermal conversion factor of 5.359 million Btu per barrel, as listed in MER, Appendix A.

Because biodiesel is produced from soybeans, corn, and other biomass inputs, EIA defines the total heat content of biofuel from biodiesel to be the total biomass inputs (feedstock) used to produce biodiesel. At the national level, EIA uses soybean oil input to the production of biodiesel (million Btu soybean oil per barrel biodiesel) as the factor to estimate total biomass inputs to the production of biodiesel. EIA defines losses and co-products from biodiesel production as total biomass inputs minus biodiesel produced.

SEDS allocates the MER U.S.-level losses and co-products from biodiesel production to the states using the

[3] Losses and co-products are the difference between the heat content of the biomass inputs (feedstock such as corn and soy) to the production of biofuels and the heat content of the biofuels produced.

state-level biodiesel production estimates. The state total heat content of biomass inputs to the production of biodiesel is the sum of the Btu values of biodiesel production and the losses and co-products.

Variable names and definitions

The independent data series identifying codes for biodiesel data are ("ZZ" represents the two-letter state code in the variable names):

BDPRPUS	=	biodiesel liquids production, in thousand barrels, United States;
BDPRPZZ	=	biodiesel liquids production, in thousand barrels, by state; and
BDLCBUS	=	energy losses and co-products from the production of biodiesel, in billion Btu, United States.

The heat content data series are:

BDPRBZZ	=	biodiesel liquids production, in billion Btu, by state
	=	BDPRPZZ * 5.359
BDLCBZZ	=	energy losses and co-products from the production of biodiesel, in billion Btu, by state
	=	BDLCBUS * (BDPRBZZ / BDPRBUS)
BDFDBZZ	=	biodiesel production (total biomass inputs as feedstock), including liquids and losses & co-products, in billion Btu, by state
	=	BDPRBZZ + BDLCBZZ

The U.S. totals that are not from external sources are the sum of the states' values:

BDPRBUS	=	ΣBDPRBZZ
BDFDBUS	=	ΣBDFDBZZ

Data sources

BDPRPUS — Biodiesel liquids production, in thousand barrels, United States.

- 2001 forward: EIA, *Monthly Energy Review*, Table 10.4a.

BDPRP (PADD-level) — Biodiesel liquids production, in million gallons, Petroleum Administration for Defense District.

- 2009 through 2020: EIA, *Monthly Biodiesel Production Report*, Table 5.

BDPRPZZ — Biodiesel liquids production, in thousand barrels, by state.

- 2021 forward: Production data from available state data sources and EIA estimates based on operating capacity data from EIA Form EIA-819, "Monthly Report of Biofuels, Fuels from Non-Biogenic Wastes, Fuel Oxygenates, Isooctane, and Isooctene."
- 2001 through 2020: Production data from available state data sources and EIA estimates based on operating capacity data from EIA Form EIA-22M, "Monthly Biodiesel Production Survey" and other sources.

BDLCBUS — Energy losses and co-products from the production of biodiesel, in billion Btu, United States.

- 2001 forward: EIA, *Monthly Energy Review*, Table 10.4a.

Fuel ethanol

Production in physical units

For 1981 forward, EIA publishes U.S.-level fuel ethanol production data in the *Monthly Energy Review* (MER) and SEDS estimates annual state-level fuel ethanol production. When available, SEDS uses reported fuel ethanol production data. For states without reported data, SEDS estimates state-level fuel ethanol production using data from various sources.

For 2010 forward, EIA estimates state-level fuel ethanol production for SEDS using data from Form EIA-819

"Monthly Report of Biofuels, Fuels from Non-Biogenic Wastes, Fuel Oxygenates, Isooctane, and Isooctene" and monthly plant-level operating production capacity from the Nebraska Energy Office. SEDS uses unpublished EIA-819 ethanol production data for 12 states in PADD 2 that would not result in the disclosure of identifiable data reported by operators using Form EIA-819. These 12 states in PADD 2 cover about 90% of total U.S. production.

For the remaining states, SEDS allocates the PADD region remainder proportionally to the states using their operating production capacity. SEDS uses monthly data on plant-level operating production capacity to compute the annual average state-level operating capacity. SEDS subtracts the available state fuel ethanol production data from the corresponding PADD total production and allocates the remainder to the other states in the PADD using the share of the state's operating capacity.

Before 2010, SEDS estimates state-level fuel ethanol production using state reported data and state-level operating production capacity estimates. SEDS obtained production data from Iowa and Washington (through 2009), and Minnesota, Nebraska, and South Dakota (through 2007).[2] These five states accounted for about two-thirds of total U.S. fuel ethanol production in 2007. SEDS allocates the remaining portion of the U.S. fuel ethanol production to the other states using state-level operating production capacity estimates.

SEDS compiles state-level operating capacity data from multiple sources. For 2005 through 2009, SEDS uses monthly plant-level data published by the Nebraska Energy Office (which were based on operating capacity data from the Renewable Fuels Association and plant locations for multi-state companies) to compile the annual average state-level operating capacity. SEDS also uses the January 2005 capacity data to approximate 2004 capacity. For 1992 through 1994, SEDS uses operating capacity data as of January 1, 1993 through 1995 published in EIA's *Petroleum Supply Annual*. For the remaining years, SEDS collects information on plant opening, expansion, and closing to estimate state-level capacity. When no information is available for a state, SEDS estimates capacity using linear interpolation for 1995 through 2003 and assumes capacity before 1992 to be the same as 1992.

Heat content of biomass inputs to the production of fuel ethanol

EIA defines the heat content of biofuel from fuel ethanol to be the total biomass inputs (feedstock, mostly corn) used to produce fuel ethanol. At the national level, EIA uses corn input to the production of fuel ethanol (million Btu corn per barrel fuel ethanol) as the factor to estimate total biomass inputs. The losses and co-products from fuel ethanol is equal to total biomass inputs minus fuel ethanol produced.

Before calculating the heat content of fuel ethanol produced, SEDS makes an adjustment to the fuel ethanol volume in physical units to remove the denaturant (typically natural gasoline added to the ethanol to make it unfit for human consumption). For 2009 forward, EIA's *Monthly Energy Review* estimates the volume of denaturant for the United States using survey data. Before 2009, EIA assumes the denaturant to be 2% of fuel ethanol production. SEDS applies the annual national adjustment ratio to the states.

SEDS converts the adjusted fuel ethanol production in physical units to Btu using EIA's undenatured ethanol thermal conversion factor of 3.539 million Btu per barrel. SEDS estimates state-level losses and co-products by applying the state fuel ethanol production shares to the national losses and co-products. The heat content of the biomass inputs to the production of fuel ethanol is equal to the sum of the fuel ethanol production and losses and co-products.

Variable names and definitions

The independent data series identifying codes for fuel ethanol data are ("ZZ" represents the two-letter state code in the variable names):

ENPRPUS = fuel ethanol production, including denaturant, in thousand barrels, United States;
ENPRPZZ = fuel ethanol production, including denaturant, in thousand barrels, by state;
EMPRPUS = fuel ethanol production, excluding denaturant, in thousand barrels, United States; and
EMLCBUS = energy losses and co-products from the production of fuel ethanol, in billion Btu, United States.

The computed data series are:

[4] Some data in the earlier years for Minnesota, Nebraska, South Dakota, and Wisconsin are not available and SEDS estimates them using plant capacity information or with assumptions.

EMPRPZZ = fuel ethanol production, excluding denaturant, in thousand barrels, by state
= ENPRPZZ * (EMPRPUS / ENPRPUS)
EMPRBZZ = fuel ethanol production, excluding denaturant, in billion Btu, by state
= EMPRPZZ * 3.539
EMLCBZZ = energy losses and co-products from the production of fuel ethanol, in billion Btu, by state
= EMLCBUS * (EMPRBZZ / EMPRBUS)
EMFDBZZ = fuel ethanol production (total biomass inputs as feedstock), including liquids and losses & co-products, in billion Btu, by state
= EMPRBZZ + EMLCBZZ

The U.S. totals that are not from external sources are the sum of the states' values:

EMPRBUS = ΣEMPRBZZ
EMFDBUS = ΣEMFDBZZ

Data sources

ENPRPUS — Fuel ethanol production, including denaturant, in thousand barrels, United States.

EMPRPUS — Fuel ethanol production, excluding denaturant, in thousand barrels, United States.

EMLCBUS — Energy losses and co-products from the production of fuel ethanol, in billion Btu, United States.

- 1981 forward: EIA, *Monthly Energy Review*, Table 10.3.

ENPRPZZ — Fuel ethanol production, including denaturant, in thousand barrels, by state.

- 1981 through 2009: Based on monthly operating production capacity data from Nebraska Energy Office (https://neo.ne.gov/); production data (for selected years) supplied by Iowa, Minnesota, Nebraska, South Dakota, and Wisconsin; capacity data from *Petroleum Supply Annual* (1992, 1993, and 1994); and other sources.
- For 2010 forward: Unpublished production data from Form EIA-819 "Monthly Report of Biofuels, Fuels from Non-Biogenic Wastes, Fuel Oxygenates, Isooctane, and Isooctene" and monthly operating production capacity data from the Nebraska Energy Office.

Renewable diesel

Production in physical units

For 2011 forward, EIA publishes U.S.-level renewable diesel production data in the *Monthly Energy Review* (MER) and SEDS estimates state-level renewable diesel production. SEDS estimates state-level renewable diesel production using data from EIA's *U.S. Renewable Diesel Fuel and Other Biofuels Plant Production Capacity* report and other sources.

For 2021 forward, SEDS estimates state-level renewable diesel production using unpublished data from EIA survey Form EIA-819, "Monthly Report of Biofuels, Fuels from Non-Biogenic Wastes, Fuel Oxygenates, Isooctane, and Isooctene", which generates the annual *U.S. Renewable Diesel Fuel and Other Biofuels Plant Production Capacity* report. Because of the volatility of renewable diesel production, instead of nameplate capacity, SEDS uses unpublished monthly data on plant-level operating status to compute an annual average "operating capacity" for each plant and aggregate them to the state level. SEDS allocates the U.S.-level renewable diesel production from the MER to the states proportionally to each state's operating capacity.

For 2011 through 2020, Form EIA-819 data are not available. SEDS estimates historical plant-level renewable diesel production "operating capacities" using available public information on individual renewable diesel plant start dates, capacity testing ramp ups, capacity expansions, capacity reductions, and shutdowns. SEDS aggregates the plant-level operating capacities by state. Then, SEDS allocates the U.S.-level renewable diesel production from the MER to the states proportionally to each state's operating capacity.

Heat content of renewable diesel

To convert renewable diesel production to British thermal units (Btu), SEDS uses EIA's renewable diesel thermal

conversion factor of 5.494 million Btu per barrel, as listed in MER, Appendix A.

Unlike biodiesel and fuel ethanol, EIA does not estimate the "biomass inputs" (feedstock) used to produce renewable diesel because EIA does not collect the information. Therefore, EIA also does not estimate losses and co-products from renewable diesel production.

Variable names and definitions

The independent data series identifying codes for renewable diesel data are ("ZZ" represents the two-letter state code in the variable names):

B1PRPUS = renewable diesel production, in thousand barrels, United States; and
B1PRPZZ = renewable diesel production, in thousand barrels, by state.

The heat content data series are:

B1PRBZZ = renewable diesel production, in billion Btu, by state
= B1PRPZZ * 5.494

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

B1PRBUS = ΣB1PRBZZ

Data sources

B1PRPUS — Renewable diesel production, in thousand barrels, United States.

- 2011 forward: EIA, *Monthly Energy Review*, Table 10.4b.

B1PRPZZ — Renewable diesel production, in thousand barrels, by state.

- 2011 through 2020: Estimated operating capacity based on public information for historical plant start dates, ramp ups, expansions, reductions, and shutdowns.
- 2021 forward: Unpublished operating capacity data from EIA survey Form EIA-819 "Monthly Report of Biofuels, Fuels from Non-Biogenic Wastes, Fuel Oxygenates, Isooctane, and Isooctene."

Other biofuels

Production in physical units

For 2014 forward, EIA publishes U.S.-level other biofuels production data in the *Monthly Energy Review* (MER). "Other biofuels" is an aggregate category for biofuels that are not biodiesel, fuel ethanol, or renewable diesel, as collected in EIA's survey Form EIA-819 "Monthly Report of Biofuels, Fuels from Non-Biogenic Wastes, Fuel Oxygenates, Isooctane, and Isooctene." Other biofuels include renewable jet fuel, renewable naphtha, renewable propane, and others. EIA does not have enough information on individual fuels or state production to estimate the states, so SEDS other biofuels production data are for the U.S.-level only.

For 2014 forward, SEDS includes U.S.-level production of other biofuels, as published in the MER.

Heat content of other biofuels

To convert other biofuels production to British thermal units (Btu), SEDS uses EIA's other biofuels conversion factor of 5.359 million Btu per barrel, as listed in MER, Appendix A.

Unlike biodiesel and fuel ethanol, EIA does not estimate the "biomass inputs" (feedstock) used to produce other biofuels because EIA does not collect the information. Therefore, EIA also does not estimate losses and co-products from other biofuels production.

Variable names and definitions

The independent data series identifying codes for other biofuels data are:

BOPRPUS = other biofuels total production, in thousand barrels, United States.

The heat content data series is:

BOPRBUS = other biofuels total production, in billion Btu, United States
= BOPRPUS * 5.359

Data sources

BOPRPUS — Other biofuels total production, in thousand barrels, United States.

- 2011 forward: EIA, *Monthly Energy Review*, Table 10.4c.

Total biofuels

Total biofuel data series are:

Physical units:

BFPRPZZ = biofuels liquid production, in thousand barrels, by state
= BDPRPZZ + ENPRPZZ + B1PRPZZ
BFPRPUS = biofuels liquid production, in thousand barrels, United States
= BDPRPUS + ENPRPUS + B1PRPUS + BOPRPUS

British thermal units:

BFPRBZZ = biofuels production (total biomass inputs as feedstock), including liquids and losses & co-products, in billion Btu, by state
= BDFDBZZ + EMFDBZZ + B1PRBZZ
BFPRBUS = biofuels production (total biomass inputs as feedstock), including liquids and losses & co-products, in billion Btu, United States
= BDFDBUS + EMFDBUS + B1PRBUS + BOPRBUS

The U.S. totals are not equal to the sum of the states' values because other biofuels are only available at the U.S. level.

Wood and waste

In general, EIA accounts for wood and waste energy production when they are consumed as energy. For 2016 forward, EIA collects data on densified biomass fuel (mostly wood pellets) production and exports. Because the United States exports about two-thirds of the densified biomass pellets, which are not domestically consumed, EIA defines wood energy production for 2016 forward as wood energy consumption plus densified biomass exports.

EIA calculates total U.S. densified biomass exports in British thermal units (Btu) from survey Form-63C, "Densified Biomass Fuel Report" and are available as an intermediate data series in EIA's *Monthly Energy Review*.

To allocate the U.S. densified biomass exports to the states, SEDS assumes that all densified biomass exports are utility wood pellets produced in the South Census Region. First, SEDS aggregates the annual operating capacity of the plants in the South Central Region that generally export densified biomass to the state-level, using EIA's *Monthly Densified Biomass Fuel Report*, Table 1. SEDS calculates state-level exports by applying the state's operating capacity share to the U.S. total densified biomass exports. Total state-level wood energy production is the sum of the estimated wood exports and consumption.

Before 2016, SEDS assumes wood energy production is equal to the SEDS wood consumption estimates.

Consumption estimates of wood and waste energy, in billion Btu, are from the SEDS consumption dataset.

Variable names and definitions

The independent data series identifying codes for renewable energy data are ("ZZ" represents the two-letter state code in the variable names):

WDEXBZZ = densified biomass exports, in billion Btu, by state (available for 2016 forward);
WDTCBZZ = wood energy total consumption, in billion Btu, by state; and
WSTCBZZ = waste energy total consumption, in billion Btu, by state.

Other data series in billion Btu are:

WDPRBZZ = wood energy production, in billion Btu, by state
= WDTCBZZ before 2016
= WDTCBZZ + WDEXBZZ for 2016 forward

WWPRBZZ = wood and waste energy production, in billion Btu, by state
= WDPRBZZ + WSTCBZZ

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

WDPRBUS = ΣWDPRBZZ
WSTCBUS = ΣWSTCBZZ
WWPRBUS = ΣWWPRBZZ

Data sources

WDEXBUS — Densified biomass exports, in billion Btu, United States.

- 2016 forward: Estimated by EIA based on EIA's *Monthly Densified Biomass Fuel Report*, exports and heat content values.

WDEXBZZ — Densified biomass exports, in billion Btu, by state.

- 2016 forward: Estimated by EIA using capacity data from EIA's *Monthly Densified Biomass Fuel Report*, Table 1 and information on the likelihood of exports.

Btu consumption estimates from SEDS are available in comma-separated value (CSV) format: https://www.eia.gov/ state/seds/sep_use/total/csv/use_all_btu.csv.

Noncombustible renewable energy sources

Noncombustible renewable energy sources covered in SEDS include:

- Geothermal energy
- Conventional hydroelectric power
- Solar thermal and photovoltaic energy
- Wind energy

EIA assumes that the production of noncombustible renewable energy is equal to consumption. The estimation methods and data sources for renewable energy consumption are described in Section 5: Renewable energy, SEDS consumption technical notes.

Variable names and definitions

The independent data series identifying codes for renewable energy data are ("ZZ" represents the two-letter state code in the variable names):

GETCBZZ = geothermal energy total consumption, in billion Btu, by state;
HYTCBZZ = hydropower total consumption, in billion Btu, by state;
SOTCBZZ = solar energy total consumption, in billion Btu, by state; and
WYTCBZZ = wind energy total consumption, in billion Btu, by state.

The noncombustible renewable energy production series is:

NCPRBZZ = noncombustible renewable energy production, in billion Btu, by state
= GETCBZZ + HYTCBZZ + SOTCBZZ + WYTCBZZ

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

GETCBUS = ΣGETCBZZ
HYTCBUS = ΣHYTCBZZ
SOTCBUS = ΣSOTCBZZ
WYTCBUS = ΣWYTCBZZ
NCPRBUS = ΣNCPRBZZ

Data sources

Btu consumption estimates from SEDS are available in comma-separated value (CSV) format: https://www.eia.gov/ state/seds/sep_use/total/csv/use_all_btu.csv.

Additional notes

1. Noncombustible renewable energy sources are mostly consumed by the electric power sector. Data for electric power generation are net generation data. Negative generation denotes that electric power consumed for plant use exceeds gross generation. A few such cases can be found in electric power generated by hydroelectric power plants.
2. During the SEDS 2022 data cycle, EIA updated the way we calculate primary energy consumption of electricity generation from noncombustible renewable energy sources (solar, wind, hydroelectric, and geothermal) to Btu using the constant conversion of 3,412 Btu per kWh (the heat content of electricity). This method is called the *captured energy approach*. Before the SEDS 2022 cycle, EIA converted noncombustible renewable energy sources to Btu using the annual U.S. average heat content of fossil fuels consumed at steam-electric power plants (FFETKUS) as a conversion factor. That method is called the *fossil fuel equivalency approach*. The *captured energy approach* is more consistent with international energy statistics standards from the United Nations than the *fossil fuel equivalency approach*. See EIA's *Monthly Energy Review* Appendix E for more information. The annual values for FFETKUS are shown in the consumption technical notes, Appendix B, Table B1, https://www.eia.gov/state/seds/seds-technical-notes-complete.php and in the SEDS thermal conversion factors time series data files https://www.eia.gov/state/seds/sep_use/total/csv/use_convfac.csv.

Total renewable energy

Total renewable energy production is:

REPRBZZ = renewable energy production, in billion Btu, by state
= BFPRBZZ + WWPRBZZ + NCPRBZZ
REPRBUS = renewable energy production, in billion Btu, United States
= BFPRBUS + WWPRBUS + NCPRBUS

The U.S. totals are not equal to the sum of the states' values because other biofuels are only available at the U.S. level.

Section 6. Total energy

Total energy production in SEDS is equal to the sum of primary energy production from coal, crude oil, natural gas (marketed production), nuclear electric power, and renewable energy, in common British thermal units (Btu):

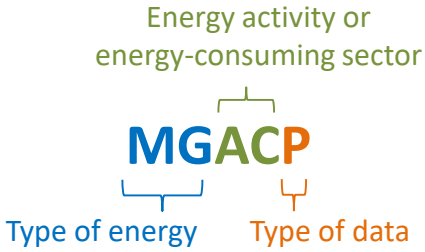
TEPRBZZ	=	total primary energy production, in billion Btu, by state
	=	CLPRBZZ + PAPRBZZ + NGMPBZZ + NUETBZZ + REPRBZZ
TEPRBUS	=	total primary energy production, in billion Btu, United States
	=	CLPRBUS + PAPRBUS + NGMPBUS + NUETBUS + REPRBUS

The U.S. total is not equal to the sum of the states' values because of federal offshore production of crude oil and natural gas and other biofuels only available at the U.S. level and not allocated any individual states.

Appendix A. Mnemonic series names (MSN)

This appendix contains an alphabetical listing of the State Energy Data System (SEDS) energy production variables, called MSNs. For each variable, SEDS provides: a brief description; unit of measure; and the formulas used to create the variable. Variables that are entered directly from other sources, but not calculated by SEDS, are independent variables. Formulas for the state calculations have "ZZ" following the variable name, where "ZZ" represents the two-letter state code and in some cases, federal offshore region code (X3 for PADD 3 Gulf Coast and X5 for PADD 5 West Coast). The formulas for the United States have "US" following the variable name. If the formula for the states, federal offshore regions, and the United States are the same, only one formula is shown.

The SEDS MSN variables have five-character names that generally consist of the following components:



See Section 1 of the SEDS consumption technical notes for explanation of the five-character MSN code descriptions.

Table A1. Production variables

MSN	Description	Unit	Formula
B1PRB	Renewable diesel production.	Billion Btu	B1PRBZZ = B1PRPZZ * 5.494 B1PRBUS = ΣB1PRBZZ
B1PRP	Renewable diesel production.	Thousand barrels	B1PRPZZ is independent. B1PRPUS is independent.
BDFDB	Biodiesel production (total biomass inputs as feedstock), including liquids and losses & co-products.	Billion Btu	BDFDBZZ = BDPRBZZ + BDLCBZZ BDFDBUS = ΣBDFDBZZ
BDLCB	Energy losses and co-products from the production of biodiesel.	Billion Btu	BDLCBZZ = BDLCBUS * (BDPRBZZ / BDPRBUS) BDLCBUS is independent.
BDPRB	Biodiesel liquids production.	Billion Btu	BDPRBZZ = BDPRPZZ * 5.359 BDPRBUS = ΣBDPRBZZ
BDPRP	Biodiesel liquids production.	Thousand barrels	BDPRPZZ is independent. BDPRPUS is independent.
BFPRB	Biofuels production (total biomass inputs as feedstock), including liquids and losses & co-products.	Billion Btu	BFPRBZZ = BDFDBZZ + EMFDBZZ + B1PRBZZ BFPRBUS = BDFDBUS + EMFDBUS + B1PRBUS + BOPRBUS
BFPRP	Biofuels liquid production.	Thousand barrels	BFPRPZZ = BDPRPZZ + ENPRPZZ + B1PRPZZ BFPRPUS = BDPRPUS + ENPRPUS + B1PRPUS + BOPRPUS
BOPRBUS	Other biofuels total production for the United States.	Billion Btu	BOPRBUS = BOPRPUS * 5.359
BOPRPUS	Other biofuels total production for the United States.	Thousand barrels	BOPRPUS is independent.
CLPRB	Coal production.	Billion Btu	CLPRBZZ = CLPRPZZ * CLPRKZZ CLPRBUS = ΣCLPRBZZ
CLPRK	Factor for converting coal production from physical units to Btu.	Million Btu per short ton	CLPRKZZ is independent. CLPRKUS = CLPRBUS / CLPRPUS
CLPRP	Coal production.	Thousand short tons	CLPRPZZ is independent. CLPRPUS = ΣCLPRPZZ
COPRKUS	Factor for converting crude oil production from physical units to Btu for the United States.	Million Btu per barrel	COPRKUS is independent.
EMFDB	Fuel ethanol production (total biomass inputs as feedstock), including liquids and losses & co-products.	Billion Btu	EMFDBZZ = EMPRBZZ + EMLCBZZ EMFDBUS = ΣEMFDBZZ
EMLCB	Energy losses and co-products from the production of fuel ethanol.	Billion Btu	EMLCBZZ = (EMPRBZZ / EMPRBUS) * EMLCBUS EMLCBUS is independent.

Table A1. Production variables (cont.)

MSN	Description	Unit	Formula
EMPRB	Fuel ethanol production, excluding denaturant.	Billion Btu	EMPRBZZ = EMPRPZZ * 3.539 EMPRBUS = ΣEMPRBZZ
EMPRP	Fuel ethanol production, excluding denaturant.	Thousand barrels	EMPRPZZ = ENPRPZZ * (EMPRPUS / ENPRPUS) EMPRPUS is independent.
ENPRP	Fuel ethanol production, including denaturant.	Thousand barrels	ENPRPZZ is independent. ENPRPUS is independent.
GETCB	Geothermal energy total consumption.	Billion Btu	GETCBZZ = GECCBZZ + GEEGBZZ + GEICBZZ + GERCBZZ GETCBUS = ΣGETCBZZ
HYTCB	Hydropower total consumption.	Billion Btu	HYTCBZZ = HYCCBZZ + HYEGBZZ + HYICBZZ HYTCBUS = ΣHYTCBZZ
NCPRB	Noncombustible renewable energy production.	Billion Btu	NCPRBZZ = GETCBZZ + HYTCBZZ + SOTCBZZ + WYTCBZZ NCPRBUS = ΣNCPRBZZ
NGELB	NGPL production, gaseous equivalent.	Billion Btu	NGELBZZ = NGELPZZ * NGELKZZ NGELBUS = ΣNGELBZZ
NGELK	Factor for converting NGPL production, gaseous equivalent, from physical units to Btu.	Thousand Btu per cubic foot	NGLEKZZ is independent. NGLEKUS is independent.
NGELP	NGPL production, gaseous equivalent.	Million cubic feet	NGELPZZ is independent. NGELPUS = ΣNGELPZZ
NGMPB	Natural gas marketed production.	Billion Btu	Before 1970: NGMPBZZ = NGMPPZZ * 1970's NGMPKZZ 1970 forward: NGMPBZZ = NGPRBZZ + NGELBZZ NGMPBUS = ΣNGMPBZZ for all years.
NGMPK	Factor for converting marketed natural gas production from physical units to Btu.	Thousand Btu per cubic foot	NGMPKZZ = NGMPBZZ / NGMPPZZ NGMPKUS = NGMPBUS / NGMPPUS
NGMPP	Natural gas marketed production.	Million cubic feet	NGMPPZZ = NGPRPZZ + NGELPZZ NGMPPUS = ΣNGMPPZZ
NGPRB	Natural gas dry production.	Billion Btu	NGPRBZZ = NGPRPZZ * NGPRKZZ NGPRBUS = ΣNGPRBZZ

Table A1. Production variables (cont.)

MSN	Description	Unit	Formula
NGPRK	Factor for converting dry natural gas production from physical units to Btu.	Thousand Btu per cubic foot	For 50 states & DC: NGPRKZZ = NGTCKZZ For Federal Offshore: NGPRK is independent. NGPRKUS is independent.
NGPRP	Natural gas dry production.	Million cubic feet	NGPRPZZ is independent. NGPRPUS = ΣNGPRPZZ
NUEGP	Nuclear electricity net generation in the electric power sector.	Million kilowatthours	NUEGPZZ is independent. NUEGPUS = ΣNUEGPZZ
NUETB	Nuclear energy consumed for electricity generation, total.	Billion Btu	NUETBZZ = NUEGBZZ NUETBUS = NUEGBUS
PAPRB	Crude oil production (including lease condensate).	Billion Btu	PAPRBZZ = PAPRPZZ * COPRKUS PAPRBUS = ΣPAPRBZZ
PAPRP	Crude oil production (including lease condensate).	Thousand barrels	PAPRPZZ is independent. PAPRPUS = ΣPAPRPZZ
REPRB	Renewable energy production.	Billion Btu	REPRBZZ = BFPRBZZ + WWPRBZZ + NCPRBZZ REPRBUS = BFPRBUS + WWPRBUS + NCPRBUS
SOTCB	Solar energy total consumption.	Billion Btu	SOTCBZZ = SOCCBZZ + SOEGBZZ + SOICBZZ + SORCBZZ SOTCBUS = ΣSOTCBZZ
TEPRB	Total primary energy production.	Billion Btu	TEPRBZZ = CLPRBZZ + PAPRBZZ + NGMPBZZ + NUETBZZ + REPRBZZ TEPRBUS = CLPRBUS + PAPRBUS + NGMPBUS + NUETBUS + REPRBUS
TETCB	Total energy consumption.	Billion Btu	TETCBZZ = ELISBZZ + ELNIBZZ + FFTCBZZ + NUETBZZ + RETCBZZ TETCBUS = ELNIBUS + FFTCBUS + NUETBUS + RETCBUS
WDEXB	Densified biomass exports (available for 2016 forward).	Billion Btu	WDEXBZZ is independent. WDEXBUS is independent.
WDPRB	Wood energy production.	Billion Btu	Before 2016: WDPRBZZ = WDTCBZZ 2016 forward: WDPRBZZ = WDTCBZZ + WDEXBZZ WDPRBUS = ΣWDPRBZZ for all years.

Table A1. Production variables (cont.)

MSN	Description	Unit	Formula
WDTCB	Wood energy total consumption.	Billion Btu	WDTCBZZ = WDCCBZZ + WDEIBZZ + WDICBZZ + WDRCBZZ WDTCBUS = ΣWDTCBZZ
WSTCB	Waste energy total consumption.	Billion Btu	WSTCBZZ = WSCCBZZ + WSEIBZZ + WSICBZZ WSTCBUS = ΣWSTCBZZ
WWPRB	Wood and waste energy production.	Billion Btu	WWPRBZZ = WDPRBZZ + WSTCBZZ WWPRBUS = ΣWWPRBZZ
WYTCB	Wind energy total consumption.	Billion Btu	WYTCBZZ = WYCCBZZ + WYEGBZZ + WYICBZZ WYTCBUS = ΣWYTCBZZ