

Introduction to the technical notes

Purpose

The U.S. Energy Information Administration (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, carbon dioxide (CO₂) emissions, and indicators. SEDS provides annual time series of CO₂ emissions from energy consumption by state and sector to help users analyze state energy and its interaction with the economy and the environment.

The terms *CO₂ emissions from energy consumption* and *energy-related CO₂ emissions* are interchangeable and refer to emissions from primary energy consumption released at the location where fossil fuels are combusted (burned). In SEDS, we attribute CO₂ emissions for electricity generation to the state where the fossil fuels are burned as primary energy, even if the electricity is later consumed in a different state. Therefore, SEDS does not estimate CO₂ emissions for electricity sales, only primary energy used to generate electricity in the electric power, commercial, and industrial sectors. Similarly, for non-combustion (nonfuel) uses of fossil fuels, such as petroleum used to make plastics, we attribute that nonfuel energy consumption to the states where the petrochemicals are consumed as primary energy at production plants, even if the final products are later used in different states.

The SEDS energy-related CO₂ emissions data are for fossil fuels only, and exclude any emissions from nuclear and renewable energy, including CO₂ emissions from biomass such as biofuels, wood, and biomass waste. The underlying assumption is that biomass CO₂ emissions are carbon neutral, meaning they are fully offset by land sinks in a sustainable biomass cycle and the natural processes by which trees, crops, and other biomass remove CO₂ from the atmosphere to grow. EIA does not separately estimate other biofuels consumption by individual fuel (renewable jet fuel, renewable propane, renewable naphtha, etc.), so other biofuels product supplied is removed from EIA CO₂ emissions data but not other unknown blended consumption. CO₂ emissions data may underestimate actual CO₂ emissions to the extent that actual biomass energy consumption may not be carbon neutral.

SEDS also does not estimate other emissions types, such as sulfur oxides

(SO_x), nitrogen oxides (NO_x), or any other CO₂ equivalent (CO₂-eq) emissions from energy production or consumption. See EIA's published survey EIA-860 and EIA-923 data for sulfur dioxide and nitrogen dioxide emissions related to electricity and heat generation in the electric power, industrial and commercial sectors for 1990 forward <https://www.eia.gov/electricity/data/state/>.

Because of differences in how EIA collects and calculates national- and state-level energy consumption and CO₂ emissions data, the sum of state CO₂ emissions by fuel and sector may not equal the national total in the *Monthly Energy Review* (MER).

The report

The SEDS CO₂ emissions tables, available on the EIA website at <https://www.eia.gov/state/seds/seds-data-complete.php>, provide annual time series estimates of state-level energy CO₂ emissions by broad primary energy-consuming sectors. Companion tables containing state-level energy production, consumption, price, expenditure, and indicator estimates can be found at the same website. In addition, SEDS publishes the most recent year of data tables for state-level energy consumption, price, expenditure, and indicator estimates by source as they are updated at <https://www.eia.gov/state/seds/seds-data-fuel.php>.

SEDS provides the following technical notes to assist users in understanding and interpreting the energy-related CO₂ emissions estimates. Each section describes how SEDS estimates each individual energy source and lists the sources of all data series.

Technical notes for state-level production, consumption, prices, expenditures, and energy indicators are available at <https://www.eia.gov/state/seds/seds-technical-notes-complete.php>.

Due to page-size constraints, most of the PDF time-series tables show estimates for only selected years. However, SEDS maintains energy-related CO₂ emissions estimates for all years for 1960 forward and includes them in the HTML and PDF tables, as well as in CSV, XLSX, and ZIP data files available on EIA's website. The documentation in this report covers all years. In the published SEDS tables, all estimates with revisions since the last SEDS report that are large enough to be seen are

preceded with an “R.”

Estimates

Energy consumption estimates. The energy-related CO₂ estimates are based on the SEDS state-level primary energy consumption estimates. EIA develops estimates of energy consumption by energy sources, primary energy-consuming sectors, and by state for 1960 forward in SEDS. We estimate energy consumption using data from surveys of energy suppliers that report consumption, sales, or distribution of energy at the state level. Most SEDS estimates rely directly on collected state-level consumption data. When EIA state-level survey statistics are not available, then we use a variety of surrogate measures to estimate energy consumption. SEDS selects the surrogate measures based on the applicability as an indicator of consumption, availability, continuity over time, and consistency. For example, EIA uses “product supplied” as an approximation for petroleum consumption. EIA calculates “product supplied” as the sum of field and refinery production, plus net imports, plus net stock change. SEDS uses state-level sales survey data, regression models, and other proxies of consumption to allocate the national petroleum product supplied totals to the states. The measures of consumption and estimation methodologies are explained in detail under each energy source in the SEDS consumption technical notes <https://www.eia.gov/state/seds/seds-technical-notes-complete.php>.

Non-combustion (nonfuel) use of fossil fuels. EIA develops estimates of fossil fuels consumed but not combusted (burned), called non-combustion use of fossil fuels or nonfuel use. EIA assumes all nonfuel use occurs in the industrial sector, except for petroleum lubricants consumption in the transportation sector. EIA estimates nonfuel consumption shares at the national level for the *Monthly Energy Review* (MER) based on survey data and other assumptions as described in the MER Energy overview section endnotes. We assume the same national nonfuel shares at the state level for SEDS. See the MER Energy overview section for more information <https://www.eia.gov/totalenergy/data/monthly/>.

Carbon sequestration from nonfuel use. Some non-combustion (nonfuel) use of fossil fuels results in less CO₂ released into the atmosphere than if the fuel were combusted (burned) during consumption. Some nonfuel uses still release CO₂ emissions. EIA develops carbon sequestration factors, or the share of carbon that remains in the fossil fuel product or carbon sink during nonfuel use, at the national level for the *Monthly Energy Review* (MER) based on survey data and other

assumptions as described in the MER Environment section endnotes. We assume the same national carbon sequestration factors at the state level for SEDS. See the MER Environment section for more information <https://www.eia.gov/totalenergy/data/monthly/>.

CO₂ conversion factor estimates. EIA develops estimates of fossil fuel CO₂ conversion factors that convert energy consumption and nonfuel consumption from British thermal units (Btu) to metric tons of CO₂ emissions. EIA uses national CO₂ conversion factors provided by the U.S. Environmental Protection Agency (EPA). We assume the same national CO₂ conversion factors at the state level for SEDS. See EIA's CO₂ emissions coefficients by fuel for more information https://www.eia.gov/environment/emissions/co2_vol_mass.php.

Data sources. The original source documents cited in the technical notes include descriptions of the data collection methods, imputation or adjustment techniques, and errors associated with the processes. Due to the many different collection forms and procedures associated with the source data and estimation methods, it is not possible to develop a meaningful numerical estimate of the errors of the integrated data published in SEDS.

It is difficult to develop reliable, consistent series for long periods of time—especially in the earlier years—and SEDS must make assumptions to fill data gaps and to maintain definitional consistency. Although SEDS incorporates the most consistent series and procedures possible, users of this report should recognize the limitations of the data that are due to changing and inadequate data sources.

For example, in reports prepared by the Bureau of Mines in the late 1960s and early 1970s, petroleum consumption was equated to demand. Later, consumption was equated to apparent demand and, more recently, to product supplied. Changes in surveys and reduction of data collections, especially after 1978, disturbed the continuity of some petroleum consumption series, most notably for distillate fuel oil, residual fuel oil, and kerosene. The SEDS consumption technical notes explain these and other data inconsistencies in detail for each energy source <https://www.eia.gov/state/seds/seds-technical-notes-complete.php>.

Energy-consuming sectors

SEDS bases its energy consumption and energy-related CO₂ emissions estimates on data collected by various surveys that define the consuming sectors differently. The technical notes of this report describe how SEDS combines the collected data series for each energy source and assigns

them to the consuming sectors. To the degree possible, SEDS assigns energy consumption to the five sectors according to the following general definitions:

- **Residential sector:** An energy-consuming sector that consists of living quarters for private households. Common uses of energy associated with this sector include: space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances. The residential sector excludes institutional living quarters.
- **Commercial sector:** An energy-consuming sector that consists of service-providing facilities and equipment of: businesses; federal, state, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters and sewage treatment facilities. Common uses of energy associated with this sector include: space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a wide variety of other equipment. Note: This sector includes generators that produce electricity and/or useful thermal output primarily to support commercial activities.
- **Industrial sector:** An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing (NAICS codes 3133); agriculture, forestry, fishing, and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products. Note: This sector includes generators that produce electricity and/or useful thermal output primarily to support industrial activities.
- **Transportation sector:** An energy-consuming sector that consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another. Included are automobiles; trucks; buses; motorcycles; trains, subways, and other rail vehicles; aircraft; and ships, barges, and other waterborne vehicles. Vehicles whose primary purpose is

not transportation (such as, construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts) are classified in the sector of their primary use. In this report, natural gas used in the operation of natural gas pipelines is included in the transportation sector.

- **Electric power sector:** An energy-consuming sector that consists of electricity-only and combined-heat-and-power plants within the NAICS (North American Industry Classification System) 22 category whose primary business is to sell electricity, or electricity and heat, to the public. Note: This sector includes electric utilities and independent power producers.

Although SEDS makes the sector allocations according to these aggregations as closely as possible, some data sources collect information using different classifications. For example, electric utilities may classify commercial and industrial users by the quantity of electricity purchased rather than by the business activity of the purchaser. Before 1996, EIA collected and reported natural gas used in agriculture, forestry, and fisheries in the commercial sector. For 1996 forward, EIA collects and reports natural gas used for agriculture, forestry, and fisheries in the industrial sector instead. Another example is master-metered condominiums and apartments and buildings with a combination of residential and commercial units. In many cases, the metering and billing practices cause residential energy use of electricity, natural gas, or fuel oil to be included in the commercial sector. SEDS makes no adjustments for these discrepancies.

SEDS does not provide further disaggregated sector estimates. For example, the industrial sector cannot be broken down into the chemical or rubber industries, all manufacturing, or agriculture. Additional disaggregated regional information, such as counties or cities, are also not available in SEDS.