

Section 2. Coal

The State Energy Data System (SEDS) estimates energy-related carbon dioxide (CO₂) emissions from coal using state-level primary energy consumption estimates from SEDS, as well as national-level non-combustion (nonfuel) consumption shares, carbon sequestration factors, and CO₂ conversion factors from the U.S. Energy Information Administration's (EIA) *Monthly Energy Review* (MER).

The term energy-related CO₂ emissions refers 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 coal is combusted, even if the electricity is later consumed in a different state. Similarly, for industrial nonfuel consumption of coal, we attribute the carbon stored in products, such as cinderblocks, to the states where the products are consumed as primary energy at production plants, regardless of where the final products are used.

Energy consumption

The State Energy Data System (SEDS) estimates the amount of coal consumed, in thousand short tons, by the electric power sector and the end-use sectors. Most coal in the United States is consumed by the electric power sector to generate electricity and heat. Other uses of coal include: industrial sector electricity, coal coke manufacturing, other manufacturing, and non-combustion (nonfuel) uses; commercial sector heat and power; historical residential sector space heating (through 2008); and historical transportation sector steam engine trains (through 1977).

The U.S. Energy Information Administration (EIA) collects coal electricity data on survey Form EIA-923, "Power Plant Operations Report," and predecessor forms. SEDS uses these data directly as estimates for electric power sector coal consumption and any industrial and commercial generators greater than 1 megawatt capacity. For the industrial, commercial, residential, and transportation sectors, SEDS uses data from EIA's *Annual Coal Report* (and earlier publications), EIA-3, and EIA-6 to estimate state-level data. We convert physical unit data in thousand short tons into British thermal units (Btu) using state-level conversion factors by sector.

We use these state-level coal variables from the SEDS consumption database, in billion Btu:

CLACB	=	coal consumed by the transportation sector (through 1977);
CLCCB	=	coal consumed by the commercial sector;
CLEIB	=	coal consumed by the electric power sector;
CLKCB	=	coal consumed at coke plants (coking coal) in the industrial sector;
CLOCB	=	coal consumed by industrial users other than coke plants; and
CLRCB	=	coal consumed by the residential sector (through 2008).

See the SEDS consumption technical notes for all consumption variables, heat conversion factors, estimation methods, and data sources <https://www.eia.gov/state/seds/seds-technical-notes-complete.php?sid=US>.

Non-combustion (nonfuel) consumption

Most fossil fuels consumed in the United States are combusted (burned) to produce heat and power. However, some are used directly for non-combustion (nonfuel) uses such as construction materials, chemical feedstocks, lubricants, solvents, and waxes. The U.S. Energy Information Administration (EIA) assumes all non-combustion use of coal comes from the process of manufacturing coal coke (coking coal) in the industrial sector. Among the byproducts of the process are "coal tars" or "coal liquids," which typically are rich in aromatic hydrocarbons, such as benzene, and are used as chemical feedstock.

EIA's *Monthly Energy Review* (MER) estimates annual U.S.-level non-combustion use shares of coal tar for 1973 forward. A share of 0 means all fuel consumption was burned when used; a share of 1 means that all consumption was for non-combustion (nonfuel) purposes and not burned. Prior to 1998, the MER estimates nonfuel shares based on coal tar production data from the United States International Trade Commission's *Synthetic Organic Chemicals*. For 1998 forward, the MER estimates coal tar production using chemicals industry coal, coke, and breeze nonfuel use data from EIA, Form EIA-846, *Manufacturing Energy*.

Consumption Survey (MECS). SEDS assumes years prior to 1973 to be equal to the 1973 share. SEDS assumes that the state-level nonfuel shares are equal to the national share from the MER each year. The U.S.-level coal non-combustion use share (number between 0 and 1) variable used in SEDS is:

CLNFSUS = coal non-combustion use share.

See the *Monthly Energy Review* (MER) Energy overview and Environment sections for more information on the data sources and methods <https://www.eia.gov/totalenergy/data/monthly/>.

Carbon sequestration from non-combustion use

In the non-combustion (nonfuel) use of fossil fuels, some of the carbon is stored (sequestered) in the final product and not emitted. We account for carbon sequestered by sector from nonfuel use by removing it from the final sector CO2 emissions, using an annual factor.

EIA's *Monthly Energy Review* (MER) estimates national-level carbon sequestration factors for nonfuel use. SEDS assumes the state-level sequestration factors are equal to the MER's national-level factor for all years. Sequestration factors range from 0 to 1. A factor of 0 indicates that the fuel does not sequester any carbon (all is emitted), while a factor of 1 indicates that the fuel sequesters all the carbon (none is emitted). EIA's carbon sequestration factor for coal at coking plants is 0.75 for all years. The U.S.-level coal sequestration factor (number between 0 and 1) variable used in SEDS is:

CLSQSUS = coal consumed at coke plants (coking coal) nonfuel carbon sequestration factor.

See the MER Environment section for more information <https://www.eia.gov/totalenergy/data/monthly/>.

Carbon dioxide (CO2) emissions

SEDS calculates coal carbon dioxide (CO2) emissions estimates in million metric tons (MMmt) as the product of the SEDS consumption values, the carbon sequestered by non-combustion use for the industrial sector, and the annual coal CO2 emissions factors by sector at https://www.eia.gov/environment/emissions/xls/CO2_coefs_detailed.xls.

Except for plant condensate and unfractionated stream (which are EIA estimates), the CO2 emissions factors for fossil fuels are from the U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, Tables A-19, A-31, and A-215. EIA converts metric tons of carbon to metric tons of CO2 using the approximate molar mass (44/12)—see <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>.

There are four coal CO2 conversion factors, in million metric tons CO2 per quadrillion Btu:

CLEIFUS = coal CO2 emissions factor for the electric power sector;
 CLHCFUS = coal CO2 emissions factor for the residential and commercial sectors;
 CLKCFUS = coal coking plants CO2 emissions factor for the industrial sector; and
 CLOCFUS = coal other than coke plants CO2 emissions factor for the industrial and transportation sectors.

For the residential, commercial, transportation, and electric power sectors, SEDS calculates state- and national-level CO2 emissions in million metric tons of CO2 (MMmt CO2) as the product of each sector's coal consumption and appropriate CO2 conversion factor, with unit conversions:

CLRCE = CLRCB * CLHCFUS / 1,000,000
 CLCCE = CLCCB * CLHCFUS / 1,000,000
 CLACE = CLACB * CLOCFUS / 1,000,000
 CLEIE = CLEIB * CLEIFUS / 1,000,000

For the industrial sector, SEDS separately calculates state-level CO2 emissions from both coking coal (CLKCE) and coal other than coke plants (CLOCE) within the industrial sector in million metric tons of CO2 (MMmt CO2). For industrial coking coal, SEDS removes the CO2 emissions sequestered from nonfuel use (CLNFE). For industrial coal other than coke plants, we assume there is no CO2 emissions sequestered from nonfuel use. The equations are:

CLKCE = (CLKCB * CLKCFUS * (1 - CLNFSUS * CLSQSUS)) / 1,000,000
 CLOCE = CLOCB * CLOCFUS / 1,000,000

State-level industrial sector total coal CO2 emissions (CLICEZZ) are the sum of CO2 emissions from coking coal and coal other than coke plants

by state, “ZZ” in the variable name is used to represent the two-letter state code:

$$\text{CLICEZZ} = \text{CLKCEZZ} + \text{CLOCEZZ}$$

State-level total coal CO2 emissions in all sectors (CLTCE) is the sum of the sectors:

$$\text{CLTCEZZ} = \text{CLRCEZZ} + \text{CLCCEZZ} + \text{CLICEZZ} + \text{CLACEZZ} + \text{CLEIEZZ}$$

Coal coke net imports

At the U.S.-level only, SEDS estimates CO2 emissions of coal coke net imports and assigns them to the industrial sector to align with national-level CO2 emissions published in EIA’s *Monthly Energy Review*. SEDS calculates coal coke net imports CO2 emissions for the United States in million metric tons of CO2 (CCNIEUS) as the product of coal coke net imports consumption in billion Btu (CCNIBUS) and the coal coke net imports CO2 emissions conversion factor in million metric tons of CO2 per quadrillion Btu (CCTCFUS), with unit conversion:

$$\begin{aligned}\text{CCNIEUS} &= \text{CCNIBUS} * \text{CCTCFUS} / 1,000,000 \\ \text{CLICEUS} &= \text{CLKCEUS} + \text{CLOCEUS} + \text{CCNIEUS}\end{aligned}$$

SEDS calculates U.S.-level total coal CO2 emissions, including coal coke net imports at the U.S.-level for the industrial sector, in million metric tons of CO2 as:

$$\text{CLTCEUS} = \text{CLRCEUS} + \text{CLCCEUS} + \text{CLICEUS} + \text{CLACEUS} + \text{CLEIEUS}$$

Data sources

State-level energy consumption estimates from EIA’s State Energy Data System (SEDS) <https://www.eia.gov/state/seds/>.

U.S.-level: non-combustion use shares, carbon sequestration factors, and CO2 emissions conversion factors from EIA’s *Monthly Energy Review* (MER) <https://www.eia.gov/totalenergy/data/monthly/>.