Section 3. Natural gas

Physical units

The State Energy Data System (SEDS) uses eight natural gas data series to derive its natural gas consumption estimates. Actual consumption data at the state level are not available. Several of these data series are deliveries of natural gas to consumers by state, which SEDS uses as consumption. SEDS sources its natural gas data, other than natural gas consumed by the electric power sector, from the *Natural Gas Annual* published by the U.S. Energy Information Administration (EIA) and its predecessors. These series, in million cubic feet, for each state are as follows (the two-letter state code is represented by "ZZ" in the following variable names):

NGCCPZZ = natural gas delivered to the commercial sector. Before 1996, includes gas used in agriculture, forestry, and fisheries;
NGINPZZ = a portion of the natural gas delivered to the industrial sector (includes gas used as fuel and feedstock in chemical plants and to produce carbon black). Beginning in 1996, includes gas used in agriculture, forestry, and fisheries;
NGLEPZZ = natural gas consumed as lease fuel;
NGPLPZZ = natural gas consumed as plant fuel;
NGPZPZZ = natural gas for pipeline and distribution use;
NGRCPZZ = natural gas delivered to the residential sector; and
NGVHPZZ = natural gas consumed as vehicle fuel.

SEDS sources its data for natural gas consumption by the electric power sector from Form EIA-923, "Power Plant Operations Report," and predecessor forms. SEDS uses these data directly as estimates for electric power sector natural gas consumption.

NGEIPZZ = natural gas consumed by the electric power sector.

SEDS calculates the U.S. totals of these independent variables as the sum of the states' values.

SEDS combines data series other than natural gas consumed by the electric power sector into the four major end-use sectors as closely as possible. Before 1996, EIA collected and reported deliveries of natural gas for agriculture, forestry, and fisheries in the commercial sector. For 1996 forward, they were correctly reported in the industrial sector. SEDS makes no adjustment for this end-use inconsistency.

SEDS represents the residential sector's consumption of natural gas with the variable for deliveries to the residential sector, NGRCPZZ.

SEDS represents the commercial sector's consumption of natural gas with the variable for deliveries to the commercial sector, NGCCPZZ.

SEDS estimates the industrial sector's consumption of natural gas (NGICPZZ) to be the sum of natural gas delivered to the industrial sector (NGINPZZ), natural gas consumed as lease fuel (NGLEPZZ), and natural gas consumed as plant fuel (NGPLPZZ). For 1960 through 1982, SEDS contains lease and plant fuel data combined under NGLEPZZ. Beginning in 2001, EIA reported lease and plant fuel use in the federal offshore Gulf of Mexico region separately. SEDS apportions the volume to the states closest to the planning areas. See "Additional Notes" on page 26 for the method of estimating the individual state values.

NGICPZZ = NGINPZZ + NGLEPZZ + NGPLPZZ

The transportation sector's consumption of natural gas (NGACPZZ) is the sum of natural gas consumed in pipeline operations (primarily in compressors) and for distribution use (NGPZPZZ), and natural gas consumed as vehicle fuel (NGVHPZZ). Before 1990, the small amounts of natural gas consumed as vehicle fuel are included in the commercial sector consumption and cannot be identified separately; therefore, NGVHPZZ is zero before 1990.

NGACPZZ = NGPZPZZ + NGVHPZZ

SEDS represents the electric power sector's consumption of natural gas with the data series NGEIPZZ.

The total consumption of natural gas, estimated for each state, is the sum of the consumption by the end-use sectors and the electric power sector:

NGTCPZZ = NGRCPZZ + NGCCPZZ + NGICPZZ + NGACPZZ + NGEIPZZ

SEDS calculates the U.S. consumption estimates for each of the sectors and the U.S. total as the sum of the states' values.

British thermal units (Btu)

SEDS uses three state-level factors to convert the consumption of natural gas from physical units of million cubic feet to billion Btu. These factors are:

NGTCKZZ = factor for converting total natural gas consumed by all sectors from physical units to Btu;
NGEIKZZ = factor for converting natural gas consumed by the electric power sector from physical units to Btu; and
NGTXKZZ = factor for converting natural gas used by end-use sectors from physical units to Btu.

SEDS calculates total consumption of natural gas in billion Btu as follows:

NGTCBZZ = NGTCPZZ * NGTCKZZ

Before 2010, SEDS calculates electric power sector consumption of natural gas in billion Btu as follows:

NGEIBZZ = NGEIPZZ * NGEIKZZ

From 2010 forward, SEDS extracts NGEIBZZ directly from the data source to minimize rounding errors.

SEDS derives NGTXKZZ as:

NGTXKZZ = (NGTCBZZ - NGEIBZZ)/(NGTCPZZ - NGEIPZZ)

NGTXKZZ is then used to convert individual end-use sector consumption of natural gas from physical units to Btu, such as:

NGRCBZZ = NGRCPZZ * NGTXKZZ

SEDS calculates the U.S. consumption estimates in Btu for each of the sectors and the U.S. total as the sum of the states' Btu values.

Before 1972, EIA did not collect data on conversion factors for natural gas consumed for electricity generation. SEDS uses the factor for all natural gas consumed (NGTCKZZ) for electric power (NGEIKZZ) and for the end-use sectors (NGTXKZZ) for 1963 through 1971. Before 1963, EIA did not collect data on state-level conversion factors for natural gas consumption. SEDS uses a standard factor of 1.035 thousand Btu per cubic foot for all sectors in all states.

Supplemental gaseous fuels

Natural gas consumption contains a relatively small amount of supplemental gaseous fuels (SGF). These fuels are introduced into or commingled with natural gas, and increase the volume available for disposition. Such fuels include, but are not limited to: synthetic natural gas (including renewable natural gas (RNG)), propane-air, coke oven gas, refinery gas, biomass gas, air injected for Btu stabilization, and manufactured gas. Because SGF are mostly derived from fossil fuels and renewable biomass, which are already accounted for as primary energy in those categories, SEDS removes SGF from total energy consumption in Btu (see Sections 6 and 7) to eliminate double counting.

EIA's *Natural Gas Annual* has annual data on SGF supplies in physical units for each state from 1980 forward. For all states except North Dakota, SEDS uses this data series to approximate SGF contained in the natural gas delivered to users. See "Additional Note 2" on page 26 for the method of assigning North Dakota SGF supplies to North Dakota and other states for consumption. Btu consumption data before 1980 includes unknown quantities of SGF.

NGSFPZZ = supplemental gaseous fuels supplies by state in million cubic feet.

SEDS assumes that SGF are commingled with natural gas consumed by the commercial, other industrial, residential, and electric power sectors, but are not commingled with natural gas used for lease and plant fuel, pipelines, or vehicle fuel. SEDS estimates the consumption of SGF within each sector using the sector's natural gas consumption share.

NGTZPZZ = NGRCPZZ + NGCCPZZ + NGINPZZ + NGEIPZZ

SFCCPZZ = NGSFPZZ * (NGCCPZZ / NGTZPZZ)
SFINPZZ = NGSFPZZ * (NGINPZZ / NGTZPZZ)
SFRCPZZ = NGSFPZZ * (NGRCPZZ / NGTZPZZ)
SFEIPZZ = NGSFPZZ * (NGEIPZZ / NGTZPZZ)

To convert SGF from physical units to Btu, SEDS uses the appropriate natural gas conversion factors:

SFCCBZZ = SFCCPZZ * NGTXKZZ
SFINBZZ = SFINPZZ * NGTXKZZ
SFRCBZZ = SFRCPZZ * NGTXKZZ
SFEIBZZ = SFEIPZZ * NGEIKZZ

Total SGF consumed by state in Btu is equal to the sum of the four sectors with SGF:

SFTCBZZ = SFRCBZZ + SFCCBZZ + SFINBZZ + SFEIBZZ

SEDS calculates the U.S. consumption estimates for each of the variables and sectors and the U.S. total as the sum of the states' values.

Natural gas excluding supplemental gaseous fuels in Btu

To facilitate data users who prefer the double-counting of SGF be removed from natural gas, SEDS calculates a set of variables for consumption of natural gas excluding supplemental gaseous fuels in Btu:

NNACBZZ = NGACBZZ
NNCCBZZ = NGCCBZZ - SFCCBZZ
NNICBZZ = NGICBZZ - SFINBZZ
NNRCBZZ = NGRCBZZ - SFRCBZZ
NNEIBZZ = NGEIBZZ - SFEIBZZ
NNTCBZZ = NGTCBZZ - SFTCBZZ

SEDS calculates the U.S. total consumption as the sum of the states' values.

Total consumption of natural gas per capita

SEDS calculates total consumption of natural gas per capita as total natural gas consumption (including supplemental gaseous fuels) divided by the resident population ("TPOPP"). The energy indicators technical notes has information on residential population at https://www.eia.gov/state/seds/seds-technical-notes-complete.php.

SEDS calculates estimated total consumption of natural gas (including supplemental gaseous fuels) per capita for each state and the United States, in thousand cubic feet ("NGTPP") as:

NGTPP = NGTCP / TPOPP

SEDS calculates estimated total consumption of natural gas (including supplemental gaseous fuels) per capita for each state and the United States, in million Btu ("NGTPB") as:

NGTPB = NGTCB / TPOPP

Additional calculations

Although SEDS does not use U.S.-level conversion factors to calculate natural gas consumption, SEDS calculates these factors for reference

and are shown in the natural gas tables in Appendix B, https://www.eia.gov/state/seds/seds-technical-notes-complete.php:

NGEIKUS = NGEIBUS / NGEIPUS
NGTCKUS = NGTCBUS / NGTCPUS
NGTXKUS = (NGTCBUS - NGEIBUS) / (NGTCPUS - NGEIPUS)

To produce price and expenditure data, SEDS differentiates between natural gas used in the transportation sector as pipeline fuel, which is not sold and has no price, and natural gas purchased and consumed as vehicle fuel. SEDS also differentiates between natural gas used as lease and plant fuel by the natural gas industry, which is not costed, and natural gas purchased by industrial consumers. SEDS calculates Btu values for the price and expenditure tables as follows:

NGPZBZZ = NGPZPZZ * NGTXKZZ
NGVHBZZ = NGVHPZZ * NGTXKZZ
NGLPPZZ = NGLEPZZ + NGPLPZZ
NGLPBZZ = NGLPPZZ * NGTXKZZ

SEDS calculates the U.S. totals for each series as the sum of the states' values.

Additional notes

1. Beginning with 2001 data, federal offshore natural gas lease fuel consumption for Alabama, Louisiana, and Texas is reported combined under "Gulf of Mexico" in the source publication. To estimate each state's portion, SEDS totals data from the U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement (BSEE, formerly the Bureau of Ocean Energy Management and Minerals Management Service) on natural gas production for the Eastern Gulf, Central Gulf, and Western Gulf areas. Alabama's share of the Gulf of Mexico lease fuel consumption is calculated in proportion to the Eastern Gulf's share of the production total; Louisiana's share is the same proportion as the Central Gulf share, and the Texas share is in proportion to the Western Gulf share. Between 2015 and 2016, BSEE revised the historical data for production by planning area. There is no longer any production for the Eastern Gulf area and Western Gulf production is revised downward. SEDS incorporated the revised data for 2001 forward.
2. In general, SGF supplies are small relative to total natural gas consumption, and SEDS assumes they are a good measure of SGF consumption. The only exception is North Dakota. Since 1985, North Dakota's volume of SGF supplies is significant and sometimes exceeds its total natural gas consumption. SEDS assumes that 10% of SGF produced in North Dakota is consumed in the state and the rest is distributed to Iowa, Illinois, and Indiana through the Northern Border Pipeline, according to the capacity of the pipeline going into each state. The percentage allocations of the supplemental gaseous fuels supplies in North Dakota are as follows:
   - From 1985 through 1998: North Dakota (10%), Iowa (90%).
   - From 1999 forward: North Dakota (10%), Iowa (62%), Illinois (22%), Indiana (6%).
3. Beginning in 2009, pipeline and distribution use volumes include line loss, defined as known volumes of natural gas that were the result of leaks, damage, accidents, migration, and/or blow down.

Data sources

NGCCPZZ — Natural gas delivered to the commercial sector including natural gas consumed as vehicle fuel through 1989 and natural gas used in agriculture, forestry, and fisheries through 1995, by state.

- 1960 through 1966: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Natural Gas Production and Consumption," table titled "Number of consumers and volume of natural gas consumed by principal users in the United States," column "Commercial."
- 1967 through 1988: EIA, *Historical Natural Gas Annual 1930 Through 2000*, Table 16, https://www.eia.gov/naturalgas/annual/archive.
- 1989 forward: EIA, *Natural Gas Annual*, State Summaries tables, also available at https://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_vcs_mmcf_a.htm.

NGEIBZZ — Natural gas consumed by the electric power sector, in billion Btu, by state.

- 1960 through 2009: computed in SEDS.
- 2010 forward: EIA, Form EIA-923, "Power Plant Operations Report, https://www.eia.gov/electricity/data/eia923/.

NGEIKZZ — Factor for converting natural gas consumed by the electric power sector from physical units to Btu by state.

- 1960 through 1971: Assumed by EIA to be equal to the thermal conversion factor for the consumption of natural gas by all users (NGTCKZZ).
- 1972 through 1982: Calculated annually by EIA by dividing the total heat content of natural gas received at steam electric plants 25 megawatts or greater by the total quantity received at those electric plants. The heat contents and quantities received are from the FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."
- 1983 through 1988: The average heat content of natural gas received at steam electric plants 50 megawatts capacity or larger from FERC Form 423 and published from 1993 forward in Btu per cubic foot in the EIA, *Cost and Quality of Fuels for Electric Utility Plants*, Table 14. Note: For states that reported consumption on EIA-759 but were not large enough to report on FERC Form 423, factors were estimated by using previous years' factors or the factor for total natural gas consumption in the state.
- 1989 forward: Calculated by dividing the total heat content of natural gas received at electric power plants (including electric utilities and independent power producers) by the total quantity consumed in physical units collected by EIA on Form EIA-923, "Power Plant Operations Report," and predecessor forms, https://www.eia.gov/electricity/data/eia923/.

NGEIPZZ — Natural gas consumed by the electric power sector by state.

- 1960 through 1975: Federal Power Commission, News Release, "Power Production, Fuel Consumption, and Installed Capacity Data," table titled "Consumption of Fuel by Electric Utilities for Production of Electric Energy by state, Kind of Fuel, and Type of Prime Mover," sum of columns, "steam and gas turbine" and "internal combustion" under column heading "gas."
- 1976 through 1981: EIA, *Electric Power Annual* (1981), Table 67.
- 1982 through 1986: Unrounded data as published in rounded form in EIA, *Electric Power Annual*, 1986, Table 14.
- 1987: Unrounded data as published in rounded form in EIA, *Electric Power Annual* 1988, Table 13.
- 1988: Unrounded data as published in rounded form in EIA, *Electric Power Annual* 1989, Table 19.
- 1989 forward: EIA, Form EIA-923, "Power Plant Operations Report," and predecessor forms, https://www.eia.gov/electricity/data/eia923/.

NGINPZZ — A portion of the natural gas delivered to the industrial sector, including natural gas used in agriculture, forestry, and fisheries beginning in 1996, by state.

- 1960 through 1966: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Natural Gas Production and Consumption," table titled "Number of consumers and volume of natural gas consumed by principal users in the United States." Sum of data in columns "Carbon black," "Refinery fuel," and "Other industrial fuel" (which includes electric utility fuel) minus data in column "Fuel used at electric utility plants."
- 1967 through 1992: EIA, *Historical Natural Gas Annual 1930 Through 2000*, Table 16, https://www.eia.gov/naturalgas/annual/archive.
- 1993 through 1996: Unpublished data comparable to data contained in the *Natural Gas Annual*, State Summaries tables.
- 1997 forward: EIA, *Natural Gas Annual*, State Summaries tables, also available at https://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_vin_mmcf_a.htm.

NGLEPZZ — Natural gas consumed as lease fuel by state (includes natural gas consumed as plant fuel in 1960 through 1990).

- 1960 through 1966: U.S. Department of the Interior, Bureau of Mines, *Minerals Yearbook*, Natural Gas chapter. State data are not available from 1960 through 1966, although U.S. totals are available. State estimates were calculated by apportioning the U.S. totals to the states on the basis of each state's share of the U.S. total in 1967.
- 1967 through 1982: EIA, *Natural Gas Annual 1994 Volume II*, Table 14.
- 1983 forward: EIA, *Natural Gas Annual*, State Summaries tables, also available at https://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_vcl_mmcf_a.htm, and U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement (BSEE) for additional gulf coast allocation for 2001 forward https://www.bsee.gov/.

NGPLPZZ — Natural gas consumed as plant fuel by state.

- 1960 through 1982: Included with natural gas consumed as lease fuel (see NGLEPZZ).
- 1983 forward: EIA, *Natural Gas Annual*, State Summaries tables, also available at https://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_VCF_mmcf_a.htm.

NGPZPZZ — Natural gas consumed for pipeline and distribution use by state.

- 1960 through 1966: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Natural Gas Production and Consumption," table titled "Number of consumers and volume of natural gas consumed by principal users in the United States," column "Used as pipeline fuel."
- 1967 through 1992: EIA, *Natural Gas Annual 1994 Volume II*, Table 14.
- 1993 through 1996: EIA, *Historical Natural Gas Annual 1930 Through 2000*, Table 15. This report is available only via the Internet at https://www.eia.gov/naturalgas/annual/archive.
- 1997 forward: EIA, *Natural Gas Annual*, State Summaries tables, also available at https://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_vgp_mmcf_a.htm.

NGRCPZZ — Natural gas delivered to the residential sector, used as consumption, by state.

- 1960 through 1966: U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Natural Gas Production and Consumption," table titled "Number of consumers and volume of natural gas consumed by principal users in the United States," column "Residential."
- 1967 through 1988: EIA, *Historical Natural Gas Annual 1930 Through 2000*, Table 16, https://www.eia.gov/naturalgas/annual/archive.
- 1989 forward: EIA, *Natural Gas Annual*, State Summaries tables, also available at https://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_vrs_mmcf_a.htm.

NGSFPZZ — Supplemental gaseous fuels supplies by state.

- 1980 forward: EIA, *Natural Gas Annual*, Table 8, also available at https://www.eia.gov/dnav/ng/ng_prod_ss_a_EPG0_ovi_mmcf_a.htm, supplemented by data extracted from the Natural Gas Annual Respondent Query System https://www.eia.gov/naturalgas/ngqs/. For 2023, SEDS Louisiana data include company volumes missing from the *Natural Gas Annual*.

NGTCKZZ — Factor for converting natural gas consumed by all users from physical units to Btu by state.

- 1960 through 1962: EIA adopted the thermal conversion factor of 1,035 Btu per cubic foot as estimated by the Bureau of Mines and first published in the *Petroleum Statement, Annual, 1956*.
- 1963 through 1979: EIA adopted the thermal conversion factors calculated annually by the American Gas Association (AGA) and published in *Gas Facts*, an AGA annual.
- 1980 through 1996: EIA, *Historical Natural Gas Annual 1930 Through 2000*, Table 16, https://www.eia.gov/naturalgas/annual/archive.
- 1997 forward: EIA, *Natural Gas Annual*, Table 16, and unpublished revisions. Data from 2007 forward are also available at https://www.eia.gov/dnav/ng/ng_cons_heat_a_EPG0_VGTH_btucf_a.htm.

NGVHPZZ — Natural gas delivered for use as vehicle fuel by state.

- 1960 through 1989: Included in natural gas consumed by the commercial sector (See NGCCPZZ).
- 1990 through 1991: EIA, *Historical Natural Gas Annual 1930 Through 2000*, Table 16, https://www.eia.gov/naturalgas/annual/archive.
- 1992 through 2000: EIA, unpublished data from the Office of Coal, Nuclear, Electric, and Alternate Fuels (U.S. totals for 1992 forward and state values for 1997 forward) and from the Office of Energy Markets and End Use (state values for 1992 through 1996).
- 2001 forward: EIA, *Natural Gas Annual*, State Summaries tables, also available at https://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_vdv_mmcf_a.htm, supplemented by data extracted from the Natural Gas Annual Respondent Query System https://www.eia.gov/naturalgas/ngqs/. For 2018, SEDS New Hampshire data include company fleet volumes missing from the *Natural Gas Annual*.