

Section 3. Natural Gas

Physical Units

Six natural gas data series are used to derive the natural gas consumption estimates in the Combined State Energy Data System (CSEDS). Three of these data series are deliveries of natural gas to the end user by State and are used as consumption because actual consumption data at these levels are not available. The sources for the natural gas data are the reports in the *Natural Gas Annual* series published by the 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 (includes gas used by nonmanufacturing organizations, such as hotels, restaurants, retail stores, laundries, and other service enterprises, and) plus natural gas delivered to other consumers (includes deliveries to municipalities and public authorities for institutional heating and street lighting). Prior to 1996, includes gas used in agriculture, forestry, and fisheries;
- NGEUPZZ = natural gas consumed by electric utilities;
- 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 consumed as pipeline fuel;
- NGRCPZZ = natural gas delivered to the residential sector; and
- NGVHPZZ = natural gas delivered for use as vehicle fuel.

The U.S. totals of these independent variables are calculated as the sum of the States' values.

The data are combined into the four major end-use sectors used in CSEDS as closely as possible. However, natural gas data are collected by using different aggregations of users. The industrial sector in CSEDS is intended to contain energy used in agriculture, forestry, and fisheries. For natural gas, these categories were reported with commercial use of natural gas through 1995 and in the industrial sector for 1996 forward. These data cannot be separately identified and no adjustment for this end-use inconsistency could be made in CSEDS.

The residential sector's consumption of natural gas is represented by the variable for deliveries to the residential sector, NGRCPZZ.

The commercial sector's consumption of natural gas is represented by the variable for deliveries to the commercial sector, NGCCPZZ.

The industrial sector's consumption of natural gas in CSEDS, NGICPZZ, is estimated 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. The source document reports lease and plant fuel combined for 1960 through 1992; the combined data series is stored as NGLEPZZ in CSEDS.

$$\text{NGICPZZ} = \text{NGINPZZ} + \text{NGLEPZZ} + \text{NGPLPZZ}$$

The transportation sector's consumption of natural gas, NGACPZZ, is the sum of natural gas consumed in pipeline operations, primarily in compressors, NGPZPZZ, and natural gas delivered for use as vehicle fuel, NGVHPZZ. Prior to 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 prior to 1990.

$$\text{NGACPZZ} = \text{NGPZPZZ} + \text{NGVHPZZ}$$

Electric utilities' consumption of natural gas is represented by the data series NGEUPZZ.

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

$$\text{NGTCPZZ} = \text{NGRCPZZ} + \text{NGCCPZZ} + \text{NGICPZZ} + \text{NGACPZZ} + \text{NGEUPZZ}$$

The U.S. consumption estimates for each of the sectors and the U.S. total are calculated as the sum of the States' values.

British Thermal Units (Btu)

Three factors for each State are used for converting the consumption of natural gas from its physical units of million cubic feet into thousand Btu per cubic foot. Two of these State-level factors are:

NGEUKZZ = The factor for converting natural gas consumed by electric utilities from physical units to Btu; and

NGTCKZZ = The factor for converting natural gas consumed by all sectors from physical units to Btu.

These two factors are used to derive a third factor, NGNUKZZ, for converting natural gas used by all sectors other than electric utilities from physical units to Btu:

$$\begin{aligned} \text{NGTCBZZ} &= \text{NGTCPZZ} * \text{NGTCKZZ} \\ \text{NGEUBZZ} &= \text{NGEUPZZ} * \text{NGEUKZZ} \\ \text{NGNUKZZ} &= (\text{NGTCBZZ} - \text{NGEUBZZ}) / (\text{NGTCPZZ} - \text{NGEUPZZ}) \end{aligned}$$

Natural gas consumption in Btu for the residential, commercial, industrial, and transportation sectors in each State is calculated by multiplying the physical unit data by the factor NGNUKZZ, such as:

$$\begin{aligned} \text{NGACBZZ} &= \text{NGACPZZ} * \text{NGNUKZZ} \\ \text{NGCCBZZ} &= \text{NGCCPZZ} * \text{NGNUKZZ} \end{aligned}$$

The U.S. consumption estimates in Btu for each of the sectors and the U.S. total are calculated as the sum of the States' Btu values:

$$\begin{aligned} \text{NGTCBUS} &= \sum \text{NGTCBZZ} \\ \text{NGEUBUS} &= \sum \text{NGEUBZZ} \\ \text{NGACBUS} &= \sum \text{NGACBZZ} \\ \text{NGCCBUS} &= \sum \text{NGCCBZZ} \end{aligned}$$

Prior to 1972, conversion factors for natural gas consumed by electric utilities were not collected; therefore, the factor for all natural gas consumed (NGTCKZZ) is used for electric utilities (NGEUKZZ) and for the other sectors (NGNUKZZ) for 1963 through 1971. Prior to 1963, State-level conversion factors for natural gas consumption were not collected and a standard factor of 1.035 thousand Btu per cubic foot is used for all sectors in all States for 1960 through 1962.

Additional Calculations

Although CSEDS does not use U.S.-level conversion factors for calculating natural gas consumption, these factors are calculated by CSEDS for reference and are shown in the natural gas tables in Appendix C:

$$\begin{aligned} \text{NGEUKUS} &= \text{NGEUBUS} / \text{NGEUPUS} \\ \text{NGTCKUS} &= \text{NGTCBUS} / \text{NGTCPUS} \\ \text{NGNUKUS} &= (\text{NGTCBUS} - \text{NGEUBUS}) / (\text{NGTCPUS} - \text{NGEUPUS}) \end{aligned}$$

To produce price and expenditure data for the *State Energy Price and Expenditure Report (SEPER)*, CSEDS 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. CSEDS 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. Btu values are calculated in CSEDS for use in *SEPER*:

$$\begin{aligned} \text{NGPZBZZ} &= \text{NGPZPZZ} * \text{NGNUKZZ} \\ \text{NGVHBZZ} &= \text{NGVHPZZ} * \text{NGNUKZZ} \\ \text{NGLPPZZ} &= \text{NGLEPZZ} + \text{NGPLPZZ} \\ \text{NGLPBZZ} &= \text{NGLPPZZ} * \text{NGNUKZZ} \end{aligned}$$

The U.S. totals for each series are calculated as the sum of the States' values.

Data Sources

NGCCPZZ — Natural gas delivered to the commercial sector and to other consumers (municipalities and public authorities for institutional heating and street lighting), 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 forward: EIA, *Historical Natural Gas Annual 1930 Through 1999*, Table 16. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled “Search EIA by Google” type “Historical Natural Gas Annual 1930” and click the “Go” button. Select the report from the list.

NGEUKZZ — Factor for converting natural gas consumed by the electric utilities from physical units to Btu.

- 1960 through 1971: Assumed by the 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 Federal Energy Regulatory Commission (FERC) Form 423, “Monthly Report of Cost and Quality of Fuels for Electric Plants.”
- 1983 forward: 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. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled “Search EIA by Google” type “Cost and Quality of Fuels for Electric” and click on the “Go” button. Select the report from the list.

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.

NGEUPZZ — Natural gas consumed by the electric utilities 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 forward: Unrounded data as published in rounded form in EIA, *Electric Power Annual*. Data are from the report of the following year, i.e., 1987 final data are published in the *Electric Power Annual*, 1988: The specific tables are:
 - 1987: Table 13.
 - 1988 and 1989: Table 19.
 - 1990 through 1993: Table 18.
 - 1994 through 1996: Volume I, Table 15.
 - 1997: Volume I, Table A5.
 - 1998 and 1999: Volume I, Table A16.

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 forward: EIA, *Historical Natural Gas Annual 1930 Through 1999*, Table 16. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled “Search EIA by Google” type “Historical Natural Gas Annual 1930” and click the “Go” button. Select the report from the list.

NGLEPZZ — Natural gas consumed as lease fuel by State (includes natural gas consumed as plant fuel in 1960 through 1992).

- 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 1992: EIA, *Natural Gas Annual 1994 Volume II*, Table 14.
- 1993 forward: EIA, *Historical Natural Gas Annual 1930 Through 1999*, Table 15. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled "Search EIA by Google" type "Historical Natural Gas Annual 1930" and click the "Go" button. Select the report from the list.

NGPLPZZ — Natural gas consumed as plant fuel by State.

- 1960 through 1992: Included with natural gas consumed as lease fuel (see NGLEPZZ).
- 1993 forward: EIA, *Historical Natural Gas Annual 1930 Through 1999*, Table 15. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled "Search EIA by Google" type "Historical Natural Gas Annual 1930" and click the "Go" button. Select the report from the list.

NGPZPZZ — Natural gas consumed as pipeline fuel 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 forward: EIA, *Historical Natural Gas Annual 1930 Through 1999*, Table 15. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled "Search EIA by Google"

type "Historical Natural Gas Annual 1930" and click the "Go" button. Select the report from the list.

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 forward: EIA, *Historical Natural Gas Annual 1930 Through 1999*, Table 16. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled "Search EIA by Google" type "Historical Natural Gas Annual 1930" and click the "Go" button. Select the report from the list.

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 forward: EIA, *Historical Natural Gas Annual 1930 Through 1999*, Table 16. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled "Search EIA by Google" type "Historical Natural Gas Annual 1930" and click the "Go" button. Select the report from the list.

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

- 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 forward: EIA, *Historical Natural Gas Annual 1930 Through 1999*, Table 16. This report is available only via the Internet at <http://www.eia.doe.gov>. In the box titled "Search EIA by Google" type "Historical Natural Gas Annual 1930" and click the "Go" button. Select the report from the list.