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: http://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 1970-1981, 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 Mexico (GOM). Before 1997, the sources include GOM federal offshore production with Alabama, Louisiana, and Texas. Before 1997, to maintain compatibility of state-level production over time, SEDS assigns federal offshore GOM production using EIA marketed production for Federal Offshore Gulf of Mexico (1992- 1996), EIA gross withdrawals for Federal Offshore GOM (1967-1991), and U.S. Department of the Interior Outer Continental Shelf (OCS) total gas production for the GOM Planning Areas (1970-1977). SEDS removes Eastern GOM production from Alabama, Central GOM production from Louisiana, and Western GOM production from Texas.

For all years, SEDS includes federal Pacific offshore production in California, 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 http://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 from the federal offshore GOM using the conversion factors of Alabama, Louisiana, and Texas, weighted by the production shares of the Eastern, Central, and Western GOM 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 GOM federal offshore production. Before 2012, the source allocated the production to the states that processed the GOM 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 Mexico (GOM) Planning Areas. SEDS removes Eastern GOM production from Alabama, Central GOM production from Louisiana, and Western GOM 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 GOM;
NGPRKZZ = Factor for converting dry natural gas production from million cubic feet to billion Btu, by state or federal offshore GOM;
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 GOM:

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 GOM.

- 1970-2000: EIA, *Historical Natural Gas Annual 1930 Through 2000*. Sources for the data are:
  - 1970-1975: Data are based on reports received from state agencies' responses to informal data requests and the United States Geological Survey (USGS).
  - 1980-1981: EIA, Form EIA-627, "Annual Quantity and Value of Natural Gas Report," and the USGS.
  - 1982-1995: 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.
  - 1996-2000: 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.

- 1970-1997: Sources for GOM federal offshore production are:
  - 1970-1976: U.S. Department of the Interior, Bureau of Ocean Energy Management.
  - 1977-1991: EIA, Natural Gas Data, Offshore Gross Withdrawals.
  - 1992-1996: 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.

- 1970-2000: EIA, *Historical Natural Gas Annual 1930 Through 2000*. Sources for the data are:
  - 1970-1975: Data are based on reports received from state agencies' responses to informal data requests and the United States Geological Survey (USGS).
  - 1980-1981: EIA, Form EIA-627, "Annual Quantity and Value of Natural Gas Report," and the USGS.
  - 1982-1995: 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.
  - 1996-2000: 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.

- 1960-1969: U.S. Department of the Interior, Bureau of Mines, *Minerals Yearbook*.
- 1960-1969: U.S. Department of the Interior, Bureau of Ocean Energy Management (GOM 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).
  - 1970-1979: EIA adopted the thermal conversion factors calculated annually by the American Gas Association and published in *Gas Facts*.
  - 1980-1996: 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 GOM Planning Areas from the U.S. Department of the Interior.
  - 1960 forward: U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM), http://www.data.boem.gov/Production/ProdbyPlanArea/Default.aspx.