

State Energy Production Estimates

1960 through 2006

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Section 1. Introduction

The State energy production database provides annual time series of the production of energy sources by State, generally from 1960 forward. It has been compiled by the Energy Information Administration (EIA) from data collected by EIA (and its predecessor agencies) from the energy industries. It is maintained as a part of the EIA State Energy Data System (SEDS), which provides comparable State data in time series of energy production, consumption, prices, and expenditures to Members of Congress, Federal and State agencies, and the general public.

Purpose

Energy production data in physical units are collected by various Offices in EIA that conduct energy surveys. They are published in various EIA reports and, more recently, on the EIA Web sites. They are, however, usually presented for the latest or recent time periods, and data for earlier years may not even be available electronically. Furthermore, it is not possible to compare across fuels that are reported in different units or to calculate total energy production within a State. The integrated State energy production database is developed to provide a standardized set of production data that allows comparisons

- over time
- across States
- across fuels

Coverage

The energy sources used to calculate total energy production in the State energy production database include:

- Coal
- Crude oil
- Natural gas (marketed production ¹)
- Renewable energy and nuclear-generated electricity

Production data for coal, crude oil and natural gas are collected from EIA sources and earlier reports published by other agencies. They are converted from physical units (short tons, barrels, and cubic feet) to British thermal units (Btu) using estimated heat contents, so that different forms of energy can be compared.

Since most of the renewable energy sources, such as wind, hydroelectric power, geothermal, solar thermal and photovoltaic energy, and wood and waste are used for electric power generation, their production is equal to consumption, which is already available in SEDS. Similarly, the net generation of electricity from nuclear power is included in the production

¹ In contrast to EIA's *Annual Energy Review* and *Monthly Energy Review*, the State energy production database uses the concept of marketed production for natural gas. Dry natural gas production would be an appropriate measure of the production of consumer-grade natural gas, but for purposes of calculating total energy production by State, it would then be necessary to include separately the production of natural gas plant liquids by State, which are not available.

database. Production of biofuels such as fuel ethanol by State is different from their consumption. In this version of the database, biofuel production is not separately estimated, and consumption for all renewable energy sources is used as a proxy for production.

Sections 2 to 5 of this documentation describe in detail the data sources and the estimation methodologies used to derive the production series for each energy source.

Comparability

To maintain internal consistency, U.S. estimates are computed by summing the estimates for all States, including the District of Columbia. U.S. totals may not exactly equal the national data published in other EIA publications because of rounding differences or differences in estimation methodology. In particular, the differences between the U.S. production estimates in SEDS and the national data published in the *Annual Energy Review* (AER) are summarized in the box below.

Differences between Production Estimates in SEDS and AER

Annual time series of production data at the national level are published in the *Annual Energy Review* (AER) in both physical unit and Btu. The differences between the physical unit production data in SEDS and AER are very minor and are mostly because of rounding. Since SEDS computes the Btu production of coal and natural gas using State conversion factors, and uses the State consumption estimates for renewable and nuclear energy, the differences are more noticeable.

Coal

Using the State conversion factors from EIA Office of Coal, Nuclear, Electric and Alternate Fuels, SEDS coal production in Btu terms is 0 to 1.2 percent lower than the AER numbers in the past three decades. Differences in the earlier period are larger, with a maximum of 2.5 percent in 1971. The conversion factors for the national data and those for the States were compiled at different times based on the knowledge of the types and quality of coal produced. No attempt has been made to reconcile the two sets of estimates.

AER's coal production in Btu also includes waste coal supplied beginning in 1989, which is not included in the SEDS estimates.

Crude Oil

There is no noticeable difference in crude oil production data presented in SEDS and AER. A constant conversion factor of 5.8 thousand Btu per barrel is used to compile the heat content of crude oil.

Natural Gas

The computation of average State conversion factors for marketed natural gas production is explained in Section 4. The conversion factors used in AER are computed at the national level (see Thermal Conversion Factor Source Documentation in AER). The differences between the SEDS and AER series are less than 1 percent in most years. The maximum difference is 2.5 percent in 2002. No attempt has been made to reconcile the two sets of estimates.

Differences between Production Estimates in SEDS and AER (continued)

Renewable and Nuclear Energy

The SEDS and AER production estimates are the same for most renewable energy sources and nuclear-generated electricity. The only exception is biomass, a term used in AER to cover biofuels, wood, and waste.

In AER, biofuels cover the biomass inputs to the production of fuel ethanol and biodiesel. That is, both the heat content of the biofuels and the energy losses and co-products from the production of biofuels are included. This definition has not yet been incorporated into SEDS. Production estimates of fuel ethanol by States are not available in SEDS, and the consumption estimates are used instead. Also, biodiesel estimates are not currently accounted for in SEDS.

In the 2006 cycle, SEDS has adopted AER's definition of biomass waste, which excludes non-biogenic waste as from 2001. There is no noticeable difference between the two sets of data as from 1981.

Section 2. Coal

Annual coal production in short tons is collected from coal producers on Form EIA-7A and its predecessor forms. State production data are available in the *Annual Coal Report* and its predecessor publications as described under Sources below. The State data for 1960 forward used in SEDS are provided by EIA's Office of Coal, Nuclear, Electric and Alternate Fuels (CNEAF). Beginning in 2001, coal production includes a small amount of refuse recovery, which is allocated to the States by CNEAF.

The State-level conversion factors in Btu per pound are also developed by CNEAF. They are based on the heat contents of coal delivered to electric power plants collected on Form EIA-423, beginning in 1972. For States that have a significant amount of their coal consumed in coke plants or other manufacturing industries or exported, their conversion factors are adjusted upward to reflect a higher Btu content of coal produced for such uses. Factors for 1960-1971 are derived from the 1972 data. Consequently, the resultant Btu production estimates for the earlier years deviate more from the national Btu estimates, which are based on average conversion factors computed at the national level.

The conversion factors are converted from Btu per pound to million Btu per thousand short ton before they are imported into the database.

Variable Names and Definitions

The data series identifying codes for coal data are as follows (the two-letter State code is represented by "ZZ" in the variable names):

CLPRPZZ = Coal production, thousand short tons, by State
CLPRKZZ = Factor for converting coal production from thousand short tons to billion Btu, by State

Coal production in billion Btu is calculated by the following formula:

CLPRBZZ = CLPRPZZ x CLPRKZZ

The U.S. total production, CLPRPUS and CLPRBUS, are calculated as the sum of the States' values. And the average conversion factor for the U.S. total is derived:

CLPRKUS = CLPRBUS / CLPRPUS

Sources

CLPRPZZ — Coal production in short tons by State

- 1960-1975: Bureau of Mines, *Minerals Yearbook*, "Coal—Bituminous and Lignite" and "Coal—Pennsylvania Anthracite" chapters.

- 1976: Energy Information Administration (EIA), *Energy Data Reports*, “Coal—Bituminous and Lignite in 1976” and “Coal—Pennsylvania Anthracite 1976.”
- 1977 and 1978: EIA, *Energy Data Reports*, “Bituminous Coal and Lignite Production and Mine Operations,” “Coal—Pennsylvania Anthracite” and “Coal Production,” annual reports.
- 1979 and 1980: EIA, *Energy Data Reports*, “Weekly Coal Report and Coal Production,” annual reports.
- 1981-1988: EIA, *Weekly Coal Production* and *Coal Production*, annual reports.
- 1989-2000: EIA, *Coal Industry Annual*, annual reports, Table 1, <http://www.eia.doe.gov/cneaf/coal/page/acr/backissues.html>.
- 2001 forward: EIA, *Annual Coal Report*, annual reports, Table 1, <http://www.eia.doe.gov/cneaf/coal/page/acr/backissues.html>.

CLPRKZZ — Factor for converting coal production from thousand short tons to billion Btu, by State

- 1960-1971: No data available. Used 1972 factors.
- 1972-1988: Based on Federal Energy Regulatory Commission, Form FERC-423.
- 1989 forward: Based on Forms FERC-423 (1989-2001) and EIA-423 (2002 forward) (<http://www.eia.doe.gov/cneaf/electricity/page/eia423.html>) and Platts COALdat database.

Section 3. Crude Oil

Production of crude oil (including lease condensate) in thousand barrels is compiled by EIA's Office of Oil and Gas. Before 1976, it was compiled by the U.S. Department of the Interior, Bureau of Mines. Annual data at the State level from 1981 forward are extracted from EIA, Petroleum Navigator, http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdn_adc_mbbbl_a.htm. Data before 1981 are extracted from the publications described in Sources below.

Data in thousand barrels are converted into billion Btu using a fixed conversion factor of 5.8 million Btu per barrel.

Federal Offshore Production

Federal offshore crude oil production in Petroleum Administration for Defense (PAD) Districts 3 and 5 are reported separately in the Petroleum Navigator. For the purpose of computing State production estimates in SEDS, Federal offshore production is allocated to the appropriate States in the area.

For 1981 through 1986, the *Petroleum Supply Annual* reports have allocated the Federal offshore production in PAD District 3 to Louisiana and Texas, and that of PAD District 5 to California. These data are used in place of the Navigator data.

Beginning in 1987, Federal offshore production in PAD District 3 is assigned to Alabama, Louisiana, and Texas using offshore oil production information published by the U.S. Minerals Management Service. Monthly data for the Eastern, Central, and Western planning areas of the Gulf of Mexico (GOM) are processed. The annual share of the Eastern GOM is used to calculate Alabama's share of the PAD District 3 production; the Central GOM share is assigned to Louisiana; and the Western GOM share to Texas. Federal offshore production in PAD District 5 is assigned to California.

Variable Names and Definitions

The data series identifying codes for crude oil data are as follows (the two-letter State code is represented by "ZZ" in the variable names):

- | | | |
|---------|---|---|
| PAPRPZZ | = | Crude oil production (including lease condensate), thousand barrels, by State |
| COPRKZZ | = | Factor for converting crude oil production from thousand barrels to billion Btu, by State |

Crude oil production in billion Btu is calculated by the following formula:

$$\text{PAPRBZZ} = \text{PAPRPZZ} \times \text{COPRKZZ}$$

The U.S. total production, PAPRPUS and PAPRBUS, are calculated as the sum of the States' values.

Sources

PAPRPZZ – Crude oil production (including lease condensate), thousand barrels, by State

- 1960-1965: U.S. Department of the Interior, Bureau of Mines, *Crude Petroleum and Petroleum Products*, Table 5, “Production of Crude Petroleum in the United States.”
- 1966: U.S. Department of the Interior, Bureau of Mines, *Crude Petroleum, Petroleum Products and Natural Gas Liquids*, Table 5, “Production of Crude Petroleum in the United States.”
- 1967-1980: EIA, Energy Data Reports, *Crude Petroleum, Petroleum Products and Natural Gas Liquids*, Table 5, “Production of Crude Petroleum (including Lease Condensate) by PAD District and State.”
- 1981 forward: EIA, *Petroleum Supply Annual*, table on “Production of Crude Oil by PAD District and State,” also available in the Petroleum Navigator, http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdn_adc_mbbbl_a.htm.

COPRKZZ – Factor for converting crude oil production from thousand barrels to billion Btu, by State

- EIA adopted the thermal conversion factor of 5.800 million Btu per barrel as reported in a Bureau of Mines internal memorandum, “Bureau of Mines Standard Average Heating Values of Various Fuels, Adopted January 3, 1950.”

Section 4. Natural Gas (Marketed Production)

Natural gas production data in cubic feet are collected and compiled by EIA's Office of Oil and Gas (OOG).

There are several concepts that can be used to measure natural gas production. *Gross withdrawals* cover full well-stream volume extracted from oil and gas wells, including all natural gas plant liquids (NGPL) and all nonhydrocarbon gases. *Marketed production* is defined as gross withdrawals less repressuring, quantities vented and flared, and with nonhydrocarbon gases removed. The gas is then processed in natural gas processing plants that remove natural gas liquid constituents such as ethane, propane and butane (natural gas plant liquids) from the gas stream. *Dry natural gas* is the resultant product that is ready for transmission and distribution. Extraction loss is the reduction in volume of natural gas due to the removal of the liquid constituents. Information on terms and definitions, sources, and explanatory notes can be found at http://tonto.eia.doe.gov/dnav/ng/TblDefs/ng_prod_sum_tbldef2.asp.

The State energy production database in SEDS uses the concept of marketed production (see footnote 1 on page 1). Average heat content factors for marketed production at the State level are not available. By definition, however, marketed production is the sum of dry natural gas production and extraction loss. Therefore, data for dry production and extraction loss in cubic feet are converted to Btu using separate heat content factors for dry natural gas extraction loss. They are then combined to form marketed production at the State-level.

Dry Production

Annual dry natural gas production data at the State level from 1982 forward are extracted from EIA, Natural Gas Navigator, http://tonto.eia.doe.gov/dnav/ng/xls/ng_prod_sum_a_EPG0_FPD_mmcfc_a.xls. Data for 1967 through 1981 are extracted from EIA, *Historical Natural Gas Annual 1930 Through 2000*. Data before 1967 are not available.

Federal Offshore Production

Beginning in 2001, Federal offshore production in the Gulf of Mexico (GOM) is reported separately in the Natural Gas Navigator. For the purpose of computing State production estimates in SEDS, Federal offshore production is allocated to Alabama, Louisiana, and Texas using offshore natural gas production information published by the U.S. Minerals Management Service. Monthly data for the Eastern, Central, and Western planning areas of the GOM are used to derive annual values. The annual share of the Eastern GOM to total GOM is used to calculate Alabama's share of the Federal Offshore dry production; the Central GOM share is assigned to Louisiana; and the Western GOM share to Texas.

Conversion Factors

State-level heat content factors for natural gas delivered to consumers are compiled by OOG. They are used to convert dry production of natural gas from million cubic feet to billion Btu.

They are available in SEDS at http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_convfac.csv.

Extraction Loss

Annual extraction loss data at the State level from 1970 forward are extracted from EIA, Natural Gas Navigator, http://tonto.eia.doe.gov/dnav/ng/xls/ng_prod_sum_a_EPG0_VG9_mmcfa.xls.

Conversion Factors

A series of weighted average conversion factors for the five major products that comprise NGPL is calculated for each State to convert extraction loss into Btu terms.

The five major NGPL and their heat content factors used to calculate the extraction loss weighted average conversion factor in million Btu per barrel are as follows:

Ethane	3.082
Propane	3.836
Butane	4.326
Isobutane	3.974
Pentanes Plus	4.620

OOG publishes production data for each NGPL product only by Petroleum Administration for Defense (PAD) Districts and Refining Districts². These data are used to compute a weighted average NGPL conversion factor for each District.

Since extraction loss is reported in cubic feet, it is necessary to convert the District conversion factors from million Btu per barrel to thousand Btu per cubic foot. To do this, an annual ratio of U.S. total NGPL production in barrels and U.S. total extraction loss in thousand cubic feet is applied to the weighted District conversion factors. The resultant conversion factors in thousand Btu per cubic foot are then used to estimate the heat content of the extraction loss for each State within the District.

Variable Names and Definitions

The data series identifying codes for natural gas data are as follows (the two-letter State code is represented by “ZZ” in the variable names):

NGPRPZZ	=	Dry natural gas production, million cubic feet, by State
NGTCKZZ	=	Factor for converting dry natural gas production from million cubic feet to billion Btu, by State
NGELPZZ	=	Natural gas extraction loss, million cubic feet, by State
NGELKZZ	=	Factor for converting extraction loss from million cubic feet to billion Btu, by State

Dry production and extraction loss in Btu are calculated:

$$\text{NGPRBZZ} = \text{NGPRPZZ} \times \text{NGTCKZZ}$$

² For description and maps of PAD Districts and Refining Districts, see *Petroleum Supply Monthly*, Appendix A.

$$\text{NGELBZZ} = \text{NGELPZZ} \times \text{NGELKZZ}$$

Marketed production is the sum of dry production and extraction loss:

$$\begin{aligned}\text{NGMPPZZ} &= \text{Marketed natural gas production, million cubic feet, by State} \\ &= \text{NGPRPZZ} + \text{NGELPZZ} \\ \text{NGMPBZZ} &= \text{Marketed natural gas production, billion Btu, by State} \\ &= \text{NGPRBZZ} + \text{NGELBZZ} \\ \text{NGMPKZZ} &= \text{Derived conversion factor for marketed production} \\ &= \text{NGMPBZZ} / \text{NGMPPZZ}\end{aligned}$$

The U.S. marketed production, NGMPPUS and NGMPBUS, are calculated as the sum of the States' values, and the U.S. conversion factor, NGMPKUS, is derived using the same formula for the States.

Additional Notes

1. In the 2006 cycle of the State energy production data, the State conversion factors for extraction loss in 1970 through 1980, previously approximated using the 1981 factors, were updated using the methodology described above.
2. Because of the complexity in accounting for interstate flow of “raw” natural gas, there are a few cases in which extraction loss is greater than dry production at the State-level. Most of the cases are in Illinois and Nevada in the early years. For these cases, a simple average of the conversion factors for dry production and extraction loss for the specific State and year is used to convert the marketed production from cubic feet to Btu.

Sources

NGPRPZZ – Dry natural gas production, million cubic feet, by State

NGELPZZ – Natural gas extraction loss, million cubic feet, by State

- 1967-2000: EIA, *Historical Natural Gas Annual 1930 Through 2000*.
http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/historical_natural_gas_annual/hnga.html

Sources for the data are:

- 1967-1975: 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. (Revised data for earlier years are available.)
http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/natural_gas_annual/nga.html.
 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.

NGTCKZZ – Factor for converting natural gas production from million cubic feet to billion 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 and published in *Gas Facts*.
- 1980 through 1996: EIA, *Historical Natural Gas Annual 1930 Through 2000*, Table 16, http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/historical_natural_gas_annual/hnga.html.
- 1997 forward: EIA, *Natural Gas Annual*, Table 16, http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/natural_gas_annual/nga_historical.html and unpublished revisions.

Section 5. Renewable Energy and Nuclear Energy

For the purpose of estimating total energy production by State, energy produced by non-fossil sources – renewable energy and nuclear energy – are included in the database. Since most of the renewable energy sources and nuclear energy used to generate electric power is consumed as soon as it is produced, energy production is assumed to equal consumption. The only exception is biofuels (fuel ethanol and biodiesel). However, in this release of the production database, State-level production estimates for biofuels are not yet available. Therefore, consumption estimates for all renewable energy and nuclear energy sources are used as proxies for production.

Renewable energy sources covered in SEDS include:

- Fuel ethanol
- Geothermal energy
- Conventional hydroelectric power
- Solar thermal and photovoltaic energy
- Wind
- Wood and biomass waste

The definition, data sources, and estimation methodologies for each of these energy sources are described in the SEDS Consumption Technical Notes, “Section 5. Renewables” (see http://www.eia.doe.gov/emeu/states/_seds_tech_notes.html).

State-level electricity generation from nuclear energy sources are used to represent nuclear energy production. The definition, data sources, and estimation methodology are described in the SEDS Consumption Technical Notes, “Section 6. Electricity” (see http://www.eia.doe.gov/emeu/states/_seds_tech_notes.html).

Consumption estimates in billion Btu are extracted from the SEDS consumption database for incorporation into the production database.

Variable Names and Definitions

The data series identifying codes for renewable energy and nuclear energy data are as follows (the two-letter State code is represented by “ZZ” in the variable names):

REPRBZZ = Renewable energy production, billion Btu, by State
= ENTCBZZ + GETCBZZ + HYTCBZZ + SOTCBZZ + WYTCBZZ +
WDTCBZZ + WSTCBZZ
where
ENTCBZZ – Fuel ethanol total consumed, billion Btu
GETCBZZ – Geothermal total energy consumed, billion Btu
HYTCBZZ – Electricity produced from conventional hydroelectric power,
billion Btu
SOTCBZZ – Solar thermal and photovoltaic energy total consumed, billion
Btu

WYTCBZZ – Electricity produced from wind energy, billion Btu
WWTCBZZ – Wood and biomass waste energy consumed, billion Btu
NUETBZZ = Electricity total produced from nuclear power, billion Btu, by State

Additional Notes

1. Data for electric power generation are net generation data. Negative generation denotes that electric power consumed for plant use exceeds gross generation. A few such cases can be found in electric power generated by nuclear and hydroelectric power.
2. Biofuel consumption is not a good proxy for biofuel production, especially at the State level. More research will be needed to derive State-level production estimates.
3. Sources for the consumption of renewable energy in the current SEDS do not cover biodiesel, and do not include losses and co-products of fuel ethanol production.

Source

Btu consumption estimates from SEDS are available in comma-separated value (CSV) format: http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_all_btu.csv.