

Section 7. Total Energy

The preceding sections of this documentation describe how the U. S. Energy Information Administration (EIA) arrives at state end-use consumption estimates by individual energy source in the State Energy Data System (SEDS). This section describes how all energy sources are added in Btu to create total energy consumption and end-use consumption estimates.

Total Energy Consumption

Total energy consumption by state is defined in SEDS as the sum of all energy sources consumed. The total includes all primary energy sources used directly by the energy-consuming sectors (residential, commercial, industrial, transportation, and electric power), as well as net interstate flow of electricity (ELISB) and net imports of electricity (ELNIB).

Energy sources can be categorized as renewable and non-renewable sources:

Non-Renewable Sources

Fossil fuels:

- coal (CL)
- net imports of coal coke (United States only)
- natural gas excluding supplemental gaseous fuels (NN)
- petroleum products excluding fuel ethanol blended into motor gasoline and biodiesel blended into distillate fuel (PM)

Nuclear electric power (NU)

Renewable Sources

- biodiesel (BD)
- fuel ethanol minus denaturant (EM)
- geothermal direct use energy and geothermal heat pumps (GE)
- conventional hydroelectric power (HY)
- solar thermal direct use energy and photovoltaic electricity net generation (SO)
- electricity produced by wind (WY)
- wood and wood-derived fuels (WD)
- biomass waste (WS)

Total consumption of fossil fuels in billion Btu are calculated for each state

and the United States as follows:

$$\begin{aligned} \text{FFTCBZZ} &= \text{CLTCBZZ} + \text{NNTCBZZ} + \text{PMTCBZZ} \\ \text{FFTCBUS} &= \text{CLTCBUS} + \text{CCNIBUS} + \text{NNTCBUS} + \text{PMTCBUS} \end{aligned}$$

The definition and calculation of the total consumption of each fossil fuel energy source is explained in Sections 2 through 4. Renewable energy total consumption (RETCB) is described in Section 5. Nuclear electric power (NUETB), net imports of electricity (ELNIB), and net interstate flow of electricity (ELISB) are described in Section 6.

Total energy consumption in billion Btu for each state and the United States is calculated as follows:

$$\begin{aligned} \text{TETCBZZ} &= \text{FFTCBZZ} + \text{NUETBZZ} + \text{RETCBZZ} + \text{ELNIBZZ} + \text{ELISBZZ} \\ \text{TETCBUS} &= \text{FFTCBUS} + \text{NUETBUS} + \text{RETCBUS} + \text{ELNIBUS} \end{aligned}$$

Total Energy Consumption by End Use

Total energy consumption for each of the four end-use sectors (residential, commercial, industrial, and transportation) is the sum of all energy sources consumed by the sector. Each sector total includes retail sales of electricity, which is produced from other primary energy sources, and electrical system energy losses, which are allocated to the end-use sectors based on electricity sales.

Energy sources are presented as they are consumed; that is, natural gas includes supplemental gaseous fuels that are commingled with the natural gas, and petroleum products include biofuels that are blended into the products.

In general, total energy consumed by the four end-use sectors by state and for the United States as a whole include the following:

- coal (CL)
- natural gas (NG), which includes supplemental gaseous fuels
- all petroleum products (PA), which include fuel ethanol blended into motor gasoline and biodiesel blended into distillate fuel oil
- geothermal direct use energy and geothermal heat pumps (GE)
- conventional hydroelectric power (HY)
- solar thermal direct use energy and photovoltaic electricity net generation (SO)
- wood (WD)
- biomass waste (WS)
- electricity sales (ES)
- electrical system energy losses (LO)

To adjust for the underreporting of fuel ethanol in motor gasoline consumption before 1993 and biodiesel in distillate fuel oil consumption before 2009, fuel ethanol consumption is added to total consumption for the commercial, industrial, and transportation sectors before 1993 and biodiesel consumption is added to total consumption for the transportation sector before 2009. (Fuel ethanol data before 1981 and biodiesel data before 2001 are not available and are assumed to be zero.)

To prevent double counting of supplemental gaseous fuels (SF), which are accounted for as part of the fossil fuels from which they are derived, and also as part of natural gas, supplemental gaseous fuels are removed from total energy for the residential, commercial, industrial, and electric power sectors.

Specific details for each of the end-use sectors are described below.

Residential sector

From 1960 forward:

$$\text{TERCB} = \text{CLRCB} + \text{NGRCB} + \text{PARCB} + \text{GERCB} + \text{SORCB} + \text{WDRCB} + \text{ESRCB} + \text{LORCB} - \text{SFRCB}$$

Commercial sector

From 1960 through 1992:

$$\text{TECCB} = \text{CLCCB} + \text{NGCCB} + \text{PACCB} + \text{EMCCB} + \text{GECCB} + \text{HYCCB} + \text{SOCCB} + \text{WWCCB} + \text{ESCCB} + \text{LOCCB} - \text{SFCCB}$$

From 1993 forward:

$$\text{TECCB} = \text{CLCCB} + \text{NGCCB} + \text{PACCB} + \text{GECCB} + \text{HYCCB} + \text{SOCCB} + \text{WWCCB} + \text{WYCCB} + \text{ESCCB} + \text{LOCCB} - \text{SFCCB}$$

Industrial sector

The industrial sector includes energy losses and co-products from the production of fuel ethanol (EMLCB) and biodiesel (BDLCB). It includes net imports of coal coke (CCNIBUS) in the U.S. total but not in the individual state estimates because no reliable means of allocating the U.S. amount to the states has been developed.

From 1960 through 1992:

$$\text{TEICBUS} = \text{CLICBUS} + \text{CCNIBUS} + \text{NGICBUS} + \text{PAICBUS} + \text{EMICBUS} + \text{EMLCBUS} + \text{GEICBUS} + \text{HYICBUS} + \text{SOICBUS} + \text{WWICBUS} + \text{ESICBUS} + \text{LOICBUS} - \text{SFINBUS}$$

$$\text{TEICBZZ} = \text{CLICBZZ} + \text{NGICBZZ} + \text{PAICBZZ} + \text{EMICBZZ} + \text{EMLCBZZ} + \text{GEICBZZ} + \text{HYICBZZ} + \text{SOICBZZ} + \text{WWICBZZ} + \text{ESICBZZ} + \text{LOICBZZ} - \text{SFINBZZ}$$

From 1993 forward:

$$\begin{aligned} \text{TEICBUS} &= \text{CLICBUS} + \text{CCNIBUS} + \text{NGICBUS} + \text{PAICBUS} + \\ &\quad \text{BFLCBUS} + \text{GEICBUS} + \text{HYICBUS} + \text{SOICBUS} + \\ &\quad \text{WWICBUS} + \text{WYICBUS} + \text{ESICBUS} + \text{LOICBUS} - \\ &\quad \text{SFINBUS} \\ \text{TEICBZZ} &= \text{CLICBZZ} + \text{NGICBZZ} + \text{PAICBZZ} + \text{BFLCBZZ} + \text{GEICBZZ} + \\ &\quad \text{HYICBZZ} + \text{SOICBZZ} + \text{WWICBZZ} + \text{WYICBZZ} + \\ &\quad \text{ESICBZZ} + \text{LOCIBZZ} - \text{SFINBZZ} \end{aligned}$$

Transportation sector

From 1960 through 1992:

$$\text{TEACB} = \text{CLACB} + \text{NGACB} + \text{PAACB} + \text{EMACB} + \text{ESACB} + \text{LOACB}$$

From 1993 through 2008:

$$\text{TEACB} = \text{CLACB} + \text{NGACB} + \text{PAACB} + \text{BDACB} + \text{EMACB} + \text{ESACB} + \text{LOACB}$$

From 2009 forward:

$$\text{TEACB} = \text{CLACB} + \text{NGACB} + \text{PAACB} + \text{ESACB} + \text{LOACB}$$

Total End-Use Energy Consumption

Total end-use energy consumption is the sum of the four end-use sectors' energy consumption. This series is represented by "TX."

$$\text{TETXB} = \text{TEACB} + \text{TECCB} + \text{TEICB} + \text{TERCB}$$

Mathematically, total end-use energy consumption (TETXB) equals total primary energy consumption (TETCB). Conceptually, the difference between the two variables is the way in which the electric power sector is incorporated. TETXB is calculated by summing: (1) the direct consumption of primary energy sources by end-use sector; (2) total electricity retail sales to end-use sectors; and (3) the losses incurred through the generation, transmission, and distribution of electricity, which are allocated to the four end-use sectors. TETCB, on the other hand, is calculated by summing the overall consumption of each primary energy source, which includes both direct end-use consumption and consumption by the electric power sector for electricity. The slight discrepancies between TETXB and TETCB are caused by independent rounding of the components.

Total Net Energy

A set of totals is calculated to estimate consumption in the four major end-use sectors excluding each sector's share of all electrical system energy losses that are incurred in the generation, transmission, and distribution of electricity. This series is total net energy consumption and is represented by "TN."

Total net energy consumption in the residential, commercial, industrial, and transportation sectors are calculated:

TNRCB	=	TERCB - LORCB
TNCCB	=	TECCB - LOCCB
TNICB	=	TEICB - LOICB
TNACB	=	TEACB - LOACB

Total Energy Consumption per Capita

The energy consumed per person residing in each state and in the United States is estimated by dividing the total energy series ("TE") by the resident population as published by the U.S. Department of Commerce, Census Bureau. Before 1980, the U.S. total population estimates may be revised more frequently than the state population estimates, so the sum of the available states' population estimates may not equal the U.S. totals. Therefore, the U.S. total population estimates are input into SEDS instead of being calculated as the sum of the states' values. The variable names for the series are ("ZZ" in the variable name represents the two-letter state code that differs for each state)

TPOPPZZ	=	resident population estimates of each state; and
TPOPPUS	=	resident population estimates of the United States.

Estimated energy consumption per capita for each state and the United States, in million Btu, is represented by "TETPB" and is calculated:

TETPB	=	TETCB / TPOPP
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Total energy consumption per capita for the four end-use sectors are estimated:

TERPB	=	TERCB / TPOPP
TECPB	=	TECCB / TPOPP
TEIPB	=	TEICB / TPOPP
TEAPB	=	TEACB / TPOPP

Data sources

TPOPPUS — Resident population estimates of the United States. July 1 estimates for all years.

- 1960 through 2009: U.S. Department of Commerce, Census Bureau, National Intercensal Tables, <http://www.census.gov/programs-surveys/popest/data/tables.All.html>.
- 2010 forward: U.S. Department of Commerce, Census Bureau, <http://www.census.gov/data/datasets/time-series/demo/popest/2010s-state-total.html>.

TPOPPZZ — Resident population estimates by state. July 1 estimates for all years.

- 1960 through 2009: U.S. Department of Commerce, Census Bureau, State Intercensal Tables, <http://www.census.gov/programs-surveys/>

popest/data/tables.All.html.

- 2010 forward: U.S. Department of Commerce, Census Bureau, <http://www.census.gov/data/datasets/time-series/demo/popest/2010s-state-total.html>.

Total Energy Consumption per Real Dollar of Gross Domestic Product

Total energy consumption per chained (2012) dollar of output by state and the United States is estimated by dividing the total energy series (“TE”) by real gross domestic product (GDP) as published by the U.S. Department of Commerce, Bureau of Economic Analysis, beginning in 1997.

Both the national-level and state-level real GDP data are available from the U.S. Department of Commerce, Bureau of Economic Analysis “Regional Economic Accounts” dataset. There is a difference in the coverage between the two series. The difference between the sum of the states GDP and the U.S-level GDP reflects federal military and civilian activity located overseas. For details, see BEA Regional Economic Accounts: Methodologies, <http://www.bea.gov/regional/methods.cfm>.

The variable names for the series are (“ZZ” in the variable name represents the two-letter state code that differs for each state)

- GDPRXUS = real gross domestic product of the United States in million chained (2012) dollars; and
- GDPRXZZ = real gross domestic product by state in million chained (2012) dollars.

Estimated energy consumption per real chained (2012) dollar for each state and the United States, in thousand Btu per chained (2012) dollar, is represented by “TETGR” and is calculated:

$$\text{TETGR} = \text{TETCB} / \text{GDPRX}$$

Data sources

GDPRXUS — Real gross domestic product of the United States in million chained (2012) dollars.

- 1997 forward: U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Products Accounts, <https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey>.

GDPRXZZ — Real gross domestic product by state in million chained (2012) dollars.

- 1997 forward: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Accounts, <https://apps.bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1>, select

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Annual Gross Domestic Product by State, Gross Domestic Product (GDP) summary (SAGDP1), All Areas, and Real GDP (millions of chained 2012 dollars).