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 (U.S. only)
- natural gas excluding supplemental gaseous fuels (NN)
- petroleum products excluding fuel ethanol blended into motor gasoline (PM)

Nuclear electric power (NU)

Renewable Sources
- 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:

$$FFTCBZZ = CLTCBZZ + NNTCBZZ + PMTCBZZ$$
$$FFTCBUS = CLTCBUS + CCNIBUS + NNTCBUS + PMTCBUS$$

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:

$$TETCBZZ = FFTCBZZ + NUETBZZ + RETCBZZ + ELNIBZZ + ELISBZZ$$
$$TETCBUS = FFTCBUS + NUETBUS + RETCBUS + ELNIBUS$$

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 fuel ethanol that is blended into motor gasoline.

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
- 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)

Prior to 1993, motor gasoline data from the source do not include fuel ethanol, so fuel ethanol is added to the total consumption calculation from 1960 through 1992. (Fuel ethanol data before 1981 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

Distributed solar thermal direct use energy and photovoltaic electricity net

generation for the residential, commercial, and industrial sectors combined (SOHCB) are included only in the residential sector because the individual sector use cannot be identified:

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

Commercial sector

From 1960 through 1992:

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

From 1993 forward:

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

Industrial sector

The industrial sector includes energy losses and co-products from the production of fuel ethanol (EMLCB). 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:

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

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

From 1993 forward:

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

$$\text{TEICBZZ} = \text{CLICBZZ} + \text{NGICBZZ} + \text{PAICBZZ} + \text{EMLCBZZ} +$$
$$\text{GEICBZZ} + \text{HYICBZZ} + \text{SOICBZZ} + \text{WDICBZZ} +$$
$$\text{WSICBZZ} + \text{WYICBZZ} + \text{ESICBZZ} + \text{LOCIBZZ} - \text{SFINBZZ}$$

Transportation sector

From 1960 through 1992:

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

From 1993 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 retail electricity 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 consumed and is represented by "TN."

Total net energy consumed by the residential, commercial, industrial, and transportation sectors are calculated:

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

Total Energy Consumed 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. The U.S. total population may be revised more frequently than the state population estimates, so the sum of the available states' population data may not equal the U.S. totals. Therefore, the U.S. total population is 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 of each state; and
TPOPPUS	=	resident population 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

The residential, commercial, industrial, and transportation sectors' energy consumption per capita are estimated:

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

Data sources

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

- 1960 through 1989: U.S. Department of Commerce, Census Bureau http://www.census.gov/popest/data/historical/index.html.
- 1990 through 1999: U.S. Department of Commerce, Census Bureau, http://www.census.gov/popest/data/historical/index.html.
- 2000 through 2009: http://www.census.gov/popest/data/intercensal/national/nat2010.html.
- 2010 forward: http://www.census.gov/popest/data/national/totals/2015/index.html.

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

- 1960 and 1970: U.S. Department of Commerce, Census Bureau,

Statistical Abstract of the United States, 1980, Section 1 Population, "No. 10. Resident Population--States: 1950 to 1979".

- 1980: U.S. Department of Commerce, Census Bureau, http://www. census.gov/popest/data/historical/index.html.
- 1960 through 1989: U.S. Department of Commerce, Census Bureau, *Current Population Reports*, "Population Estimates and Projections," Series P-25. Specific publication numbers and table numbers:
  – 1961 through 1969: Number 460, Table 1.
  – 1971 through 1979: Number 957, Table 4.
  – 1981 through 1989: Number 1058, Table 3.
- 1990 through 1999: U.S. Department of Commerce, Census Bureau, http://www.census.gov/popest/data/historical/index.html.
- 2000 through 2009: http://www.census.gov/popest/data/ intercensal/state/state2010.html.
- 2010 forward: http://www.census.gov/popest/data/state/ totals/2015/index.html.

Total Energy Consumed per Real Dollar of Gross Domestic Product

Total energy consumed per chained (2009) 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.

There are two series available for real GDP at the national level—the national series contained in the "National Income and Product Accounts," and the U.S. GDP in the Regional Economic Accounts, the source of the state GDP dataset. These series are not strictly comparable due to slight differences in coverage, and the different sources and vintages of data used. SEDS uses the national series from the "National Income and Product Accounts" for real GDP at the U.S. level. For details on these two series, see BEA Regional Economic Accounts: Methodologies, http://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 (2009) dollars; and

GDPRXZZ   =   real gross domestic product by state in million chained (2009) dollars.

More information on GDP is available in Appendix D. http://www.eia.gov/ state/seds/sep_use/notes/use_GDP.pdf.

Estimated energy consumption per real chained (2009) dollar for each state and the United States, in thousand Btu per chained (2009) dollar, is represented by "TETGR" and is calculated:

TETGR   =   TETCB / GDPRX

Data sources

GDPRXUS — Real gross domestic product of the United States in million chained (2009) dollars.

- 1997 forward: U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Products Accounts, http://www.bea. gov/national/xls/gdplev.xls.

GDPRXZZ — Real gross domestic product by state in million chained (2009) dollars.

- 1997 forward: U.S. Department of Commerce, Bureau of Economic Analysis, http://www.bea.gov/iTable/iTable.cfm?ReqID=70&step=1, select Gross Domestic Product by State, Real GDP, NAICS classification, all industry total, and all areas.