Energy Use

People use energy for many daily tasks, including manufacturing products, heating and cooling buildings, and transporting people and goods. Overall, Americans used 98 quadrillion British thermal units (Btu) of energy in 2017—roughly equivalent to burning 781 billion gallons of conventional gasoline (EIA, 2018). The U.S. gets most of this energy from fossil fuels, which include coal, petroleum, and natural gas. A smaller portion comes from nuclear power and an even smaller portion from renewable sources such as hydropower, geothermal, and biomass.

Although energy use is an integral part of modern society, it can lead to a variety of negative impacts. Energy use not only can lead to the depletion of nonrenewable resources, but can also affect people and the environment in many ways, depending on the source, production, distribution, and use. These impacts can occur at many points during energy production and use. Examples include:

- **Impacts from extraction and processing.** Surface mining of coal (particularly "mountaintop removal") can dramatically alter landscapes, potentially eliminating habitat and adding sediment to nearby streams. Extracting oil or natural gas can introduce contaminants into the environment if proper safeguards are not followed or in the event of a malfunction (e.g., the 2010 Deepwater Horizon spill in the Gulf of Mexico and the 2015–2016 Aliso Canyon gas leak in California). Producing energy also requires energy—for example, uranium mining and tar sand oil production are energy-intensive.
- **Impacts from transporting fuels.** Oil spills at sea and natural gas pipeline explosions are perhaps the most dramatic examples of the environmental risks associated with transporting fossil fuels.
- **Air emissions.** When combusted, all fossil fuels produce carbon dioxide, which is the greenhouse gas responsible for the largest share of global climate change (IPCC, 2013; USGCRP, 2017). About 84 percent of the United States' human-influenced greenhouse gas emissions derive from energy production and use (U.S. EPA, 2018). Fossil fuel combustion is also the dominant source of many air pollutants, including carbon monoxide, nitrogen oxides, sulfur dioxide, and particulates, with well-known negative effects on human health and the environment (see the Outdoor Air indicators).
- **Impacts from wastes.** Oil and gas production create drilling wastes that must be managed properly, for example, burning coal can produce large quantities of ash. Nuclear power plants produce radioactive wastes that could contaminate the environment for thousands of years if not handled appropriately.
- **Other effects.** Water is vital to producing most of the world's electricity—not only through hydropower (dams), but also through "thermoelectric" methods (e.g., fossil fuels and nuclear energy) in which water is heated to create steam that spins a turbine to generate power. These power plants typically require even more water for cooling (see the Freshwater Withdrawals indicator)—with subsequent warm water releases into water bodies. Renewable sources can also affect the environment; for example, a hydroelectric dam can block the migration of fish.

This indicator shows trends in the amount of energy used in the U.S. from 1949 to 2017, broken

down by source (fuel) (Exhibit 1) and by end-use sector (Exhibit 2). It also serves as a basis for assessing nationwide "energy use intensity," which is measured in terms of total energy use per capita and per dollar of gross domestic product (GDP) (i.e., the total value of all goods and services produced in the U.S.) (Exhibit 3). Historically, economic growth and increased prosperity have been correlated with increased energy use (Fiksel, 2009). One important goal of sustainable development is to reduce the negative environmental impacts associated with energy production and use without reducing economic well-being. By embracing more environmentally friendly methods of energy production and using energy more efficiently, households, businesses, and society at large can realize cost savings and improve ecological and human health.

The energy use data in this indicator are based on a series of mandatory and voluntary survey forms that energy producers submit to the U.S. Energy Information Administration (EIA) on a monthly, quarterly, or annual basis. Exhibit 3 compares total national energy use with the official U.S. population and real (inflation-adjusted) GDP. These data have been indexed such that 1949 equals 1, which allows all variables to be plotted on the same scale.

What the Data Show

From 1949 to 2017, total U.S. energy use roughly tripled (Exhibit 1). Energy use has risen fairly steadily over time with the exception of a few noticeable declines in the 1970s, 1980s, and late 2000s, which were largely associated with supply shocks (e.g., the 1973 oil embargo) or economic downturn.

In 1949, the U.S. obtained 91 percent of its energy from fossil fuels (Exhibit 1). Despite the emergence of nuclear power and the growth of renewable sources, in 2017 the nation still relied on fossil fuels for 80 percent of its energy needs. For that year, the largest share (37 percent) of U.S. energy consumed was derived from petroleum (including gasoline), followed by natural gas (29 percent) and coal (14 percent). Recent years have seen increases in some sources of energy (natural gas and renewables) and decreases in others (petroleum and coal).

All of the major end use sectors—commercial, industrial, residential, and transportation—at least doubled their energy use from 1949 to 2017 (Exhibit 2). The industrial sector accounted for the largest share of energy use in 2017 (32 percent), followed by transportation (29 percent). The totals in Exhibit 2 include energy consumed in the form of electricity. If shown separately, electric power generation would account for 38 percent of total U.S. energy use in 2017 (EIA, 2018).

While energy use tripled from 1949 to 2017, the U.S. economy grew more than eight times larger (as measured in real GDP) and the population approximately doubled (Exhibit 3). As a result, the economy now produces more than twice as much value in goods and services per Btu of energy as it did in 1949. The average American now uses 40 percent more energy than in 1949, although most of the increase occurred before the mid-1970s. Energy use per capita has remained fairly steady for the last few decades.

Limitations

- This indicator does not describe the extent to which U.S. energy use is truly "sustainable." It is difficult to define exactly what constitutes "sustainability" in a complex realm such as energy, where the social and environmental impacts depend on the source (e.g., coal versus hydropower), the manner in which the source was produced (e.g., specific fossil fuel extraction methods), and the manner in which the energy has been used (e.g., where emissions are released and whether emissions control technology is used).

- This indicator does not explain whether specific sectors have become more or less efficient with regard to energy use. For example, a more comprehensive review might examine the relationship between transportation energy use and vehicle or passenger miles traveled.
- This indicator does not explain the extent to which the apparent decrease in energy intensity with respect to GDP (Exhibit 3) reflects improved efficiency within energy-intensive industries as opposed to broader structural shifts toward less energy-intensive industries (e.g., the U.S. produces less steel than it used to, but more services).
- This indicator does not measure the full impact of U.S. consumption because it excludes energy that is used in other countries to make products that are imported and used in the United States.

Data Sources

This indicator presents energy use statistics published by EIA in its Monthly Energy Review (EIA, 2018), available at https://www.eia.gov/totalenergy/data/monthly/index.php. Additionally, Exhibit 3 incorporates GDP data obtained from the U.S. Bureau of Economic Analysis (2018) and population data from the U.S. Census Bureau (2000, 2001, 2011, 2017).

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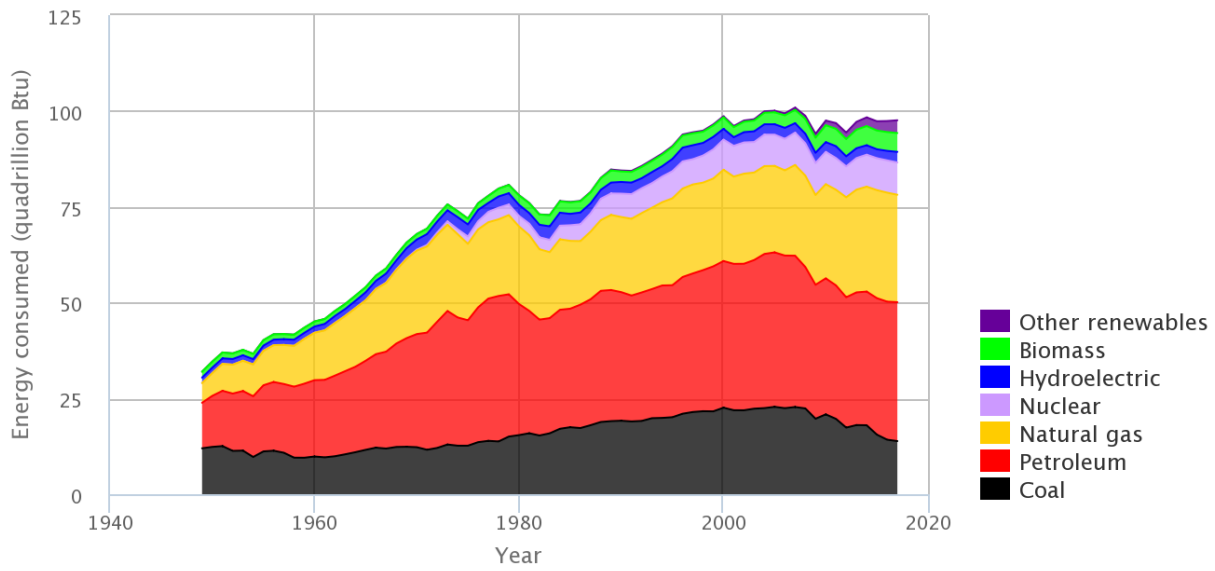
Exhibit 1. Total U.S. energy consumption by source, 1949–2017

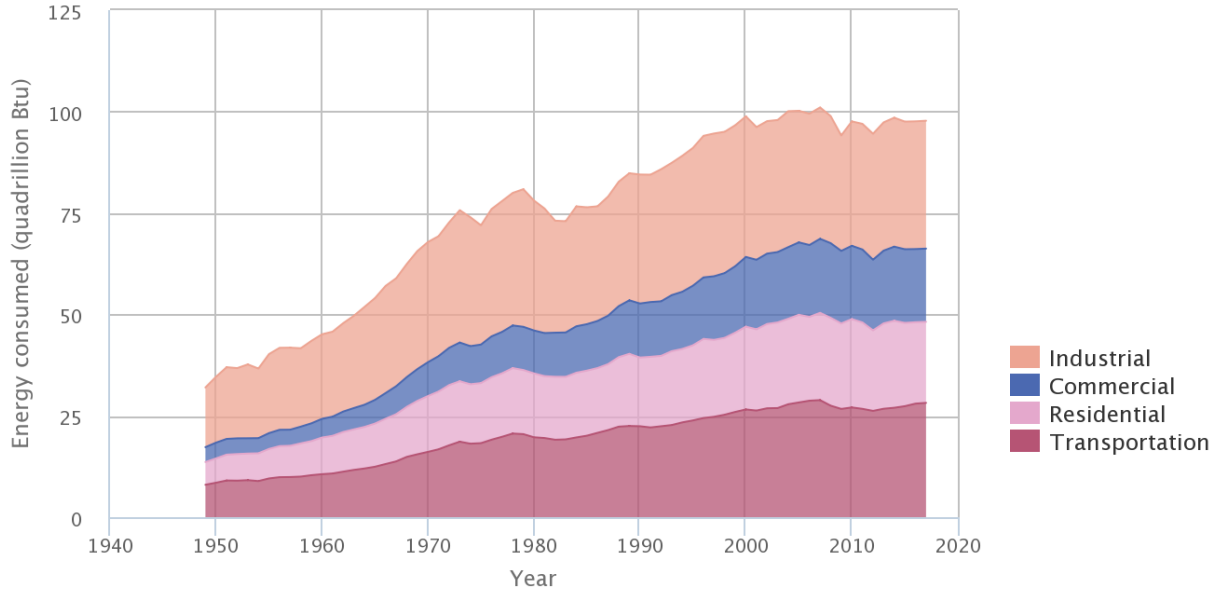


This graph does not account for net imports of electricity and coal coke, which would change the total by -0.08% to 0.24%, depending on the year.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: EIA, 2018

Exhibit 2. Total U.S. energy consumption by sector, 1949–2017

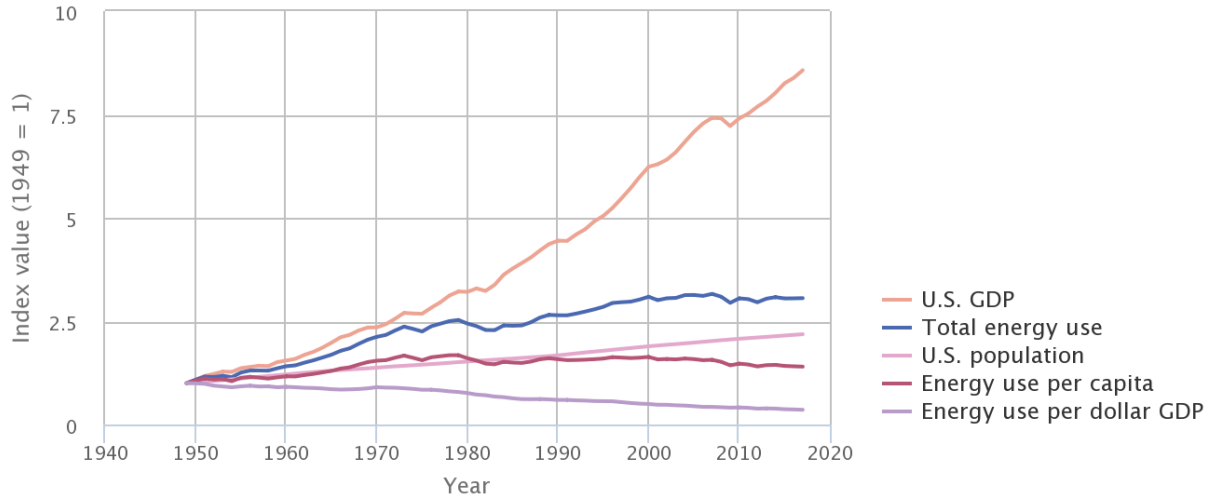


This graph includes energy consumed in the form of electricity.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: EIA, 2018

Exhibit 3. Intensity of U.S. energy consumption, 1949–2017



Based on real (inflation-adjusted) GDP.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: BEA, 2018; EIA, 2018; U.S. Census Bureau, 2000, 2001, 2011, 2018