

US Energy Resources

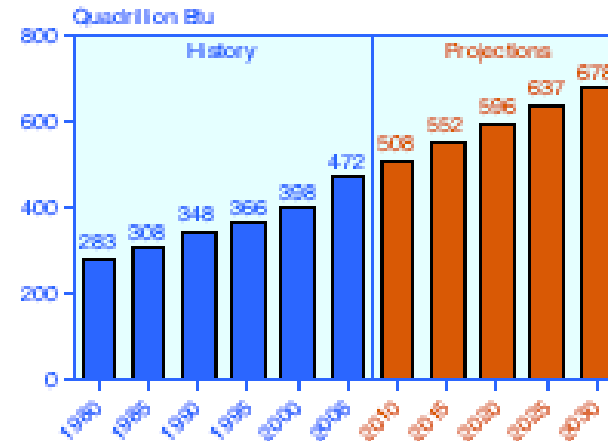
Introduction: A Global Perspective

Using data from 2005, the United States was the largest energy consumer worldwide.

- The USA used a total of **100 quadrillion BTUs** of energy.
- The world used a total of **472 quadrillion BTUs** of energy.

That means, in 2005, the United States used over 20% of the total energy used by the entire world though the U.S. contains only 5% of the world's population.

Figure 10. World Marketed Energy Consumption, 1980-2030



Sources: History: Energy Information Administration (EIA), International Energy Annual 2008 (June-December 2008), web site www.eia.doe.gov/ica. Projections: EIA, World Energy Projections Plus (2009).

Most of the world's energy—about 80 to 90 percent—is currently derived from fossil fuels. Looking ahead at worldwide energy consumption projections, the predictions show a steady increase upwards. In the United States and around the world, it is essential to start reducing our reliance on fossil fuels and producing more energy from sustainable sources.

History of US Energy Consumption

From 1850 to 2000, total energy use in the United States has increased dramatically. With each new invention comes a need for more energy and a drive to find new energy sources.



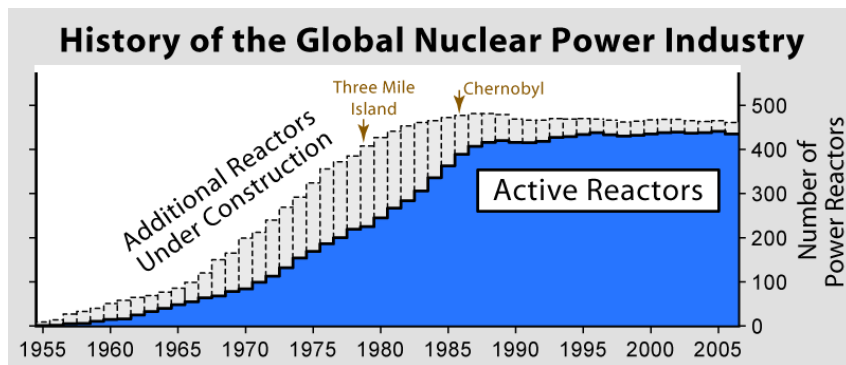
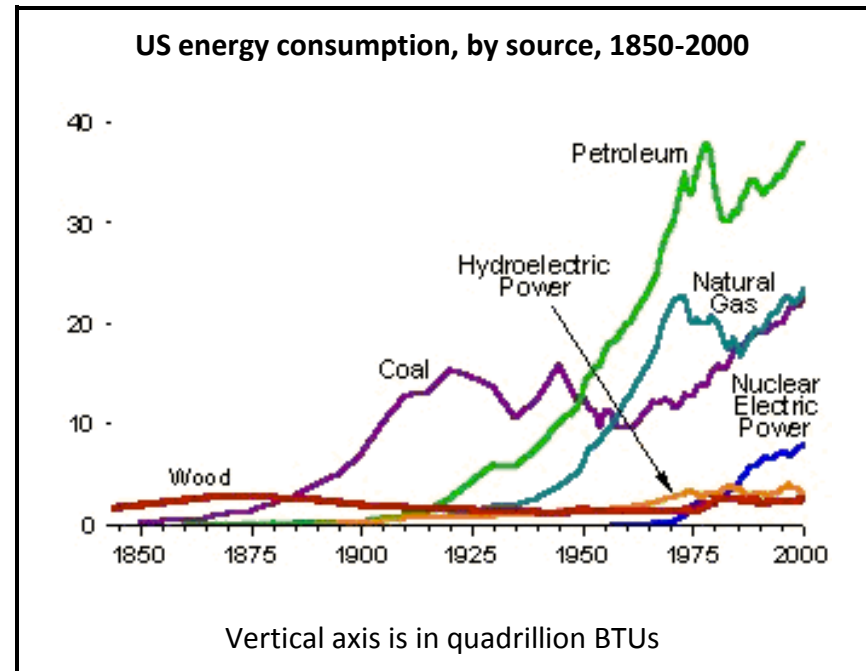
WOOD: In the early history of the United States, forests were abundant and therefore firewood was always readily available. From the founding of the country until the late 1700s, wood was the primary energy source.



COAL: In the early 1800s, industrialization and urbanization began. The railroad became a popular means of transportation—and with it—an increase in coal use. By 1885, coal became the dominant energy source.



PETROLEUM: By 1900, the USA began mass production of automobiles. They steadily emerged as a major cultural and economic force—that greatly increased petroleum use. By 1950, petroleum became the primary energy source and continues to this day.



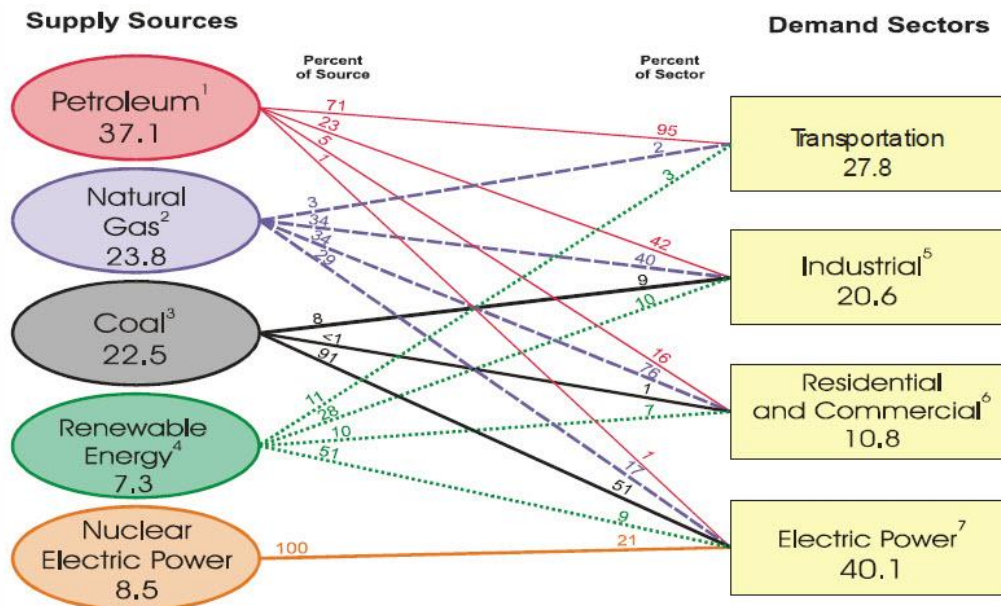
DID YOU KNOW?

Initially, nuclear power had a rapid rise. There was a lot of early interest and the number of active reactors steadily grew for about 25 years. Then, after Three Mile Island and Chernobyl, public fear set in and the rise leveled off. Now, with the Obama administration, there is renewed interest in nuclear energy and future growth is again expected.

Energy Consumption in the United States - Overview

Our demand for energy is tremendous and we still rely on fossil fuels as a substantial part of our supply sources.

U.S. Primary Energy Consumption by Source and Sector, 2008
(Quadrillion Btu)



Petroleum, natural gas, and coal account for 83.4 quadrillion BTUs. That means the USA is consuming over 80% of its energy from fossil fuels. All the demand sectors currently rely heavily on fossil fuels.

Nuclear power is a somewhat helpful alternative because it cuts down on emissions but we have not determined how to deal with the radioactive waste. Right now, nuclear only contributes to electric power.

In this chart, sustainable energy is defined as hydroelectric power, geothermal, solar, wind, and biomass. All of those energy sources are better for the environment but collectively they make up the smallest supply source.

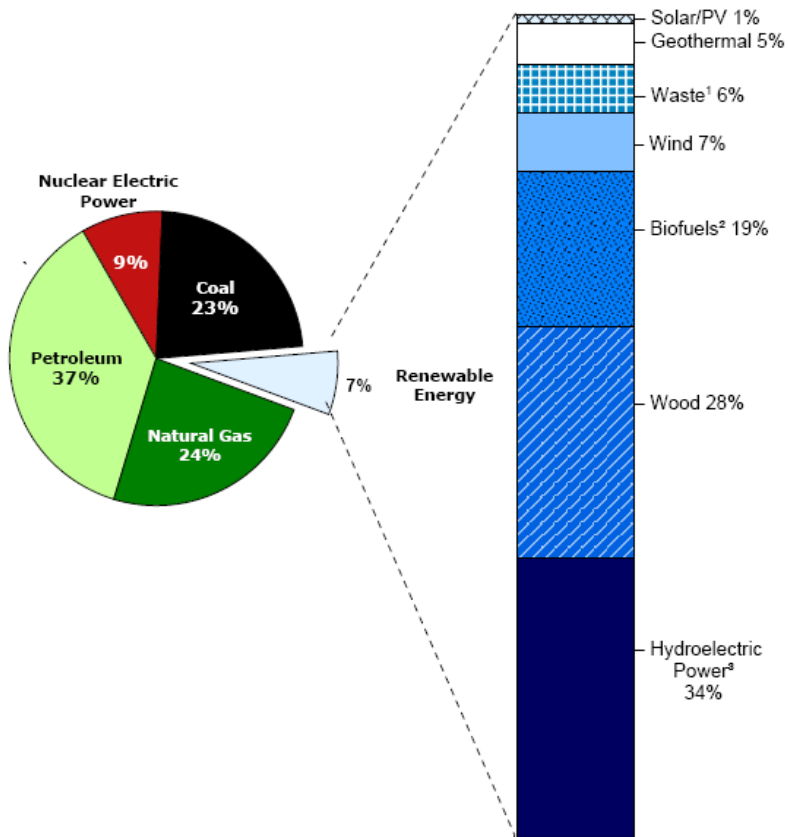
DID YOU KNOW?

Statistics show that US *per-capita* energy consumption has not changed much from 1970 to today. One explanation is that we now import more equipment, cars, and other goods from foreign countries. Thus, we've reduced the US energy consumption required to make those goods, but continue to consume more energy as a country.

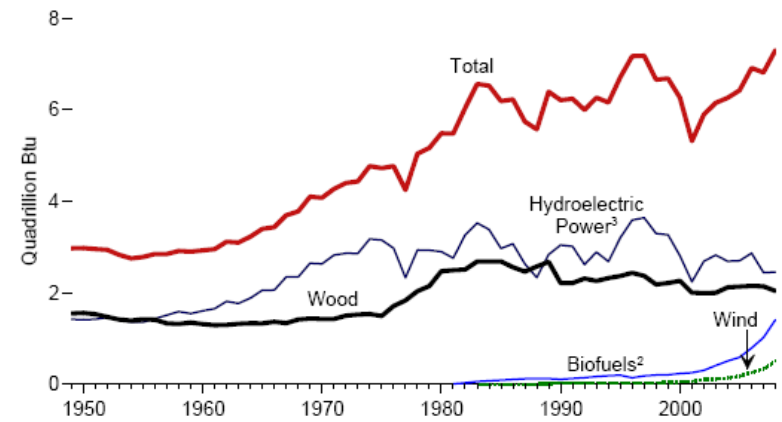
Energy Consumption in the United States – Renewable Energy

Sustainable energy represents only a small percentage of our overall consumption. But, with so many renewable energy options, the potential for growth is strong.

Renewable Energy as Share of Total Primary Energy Consumption, 2008



Renewable Energy Total Consumption and Major Sources, 1949-2008

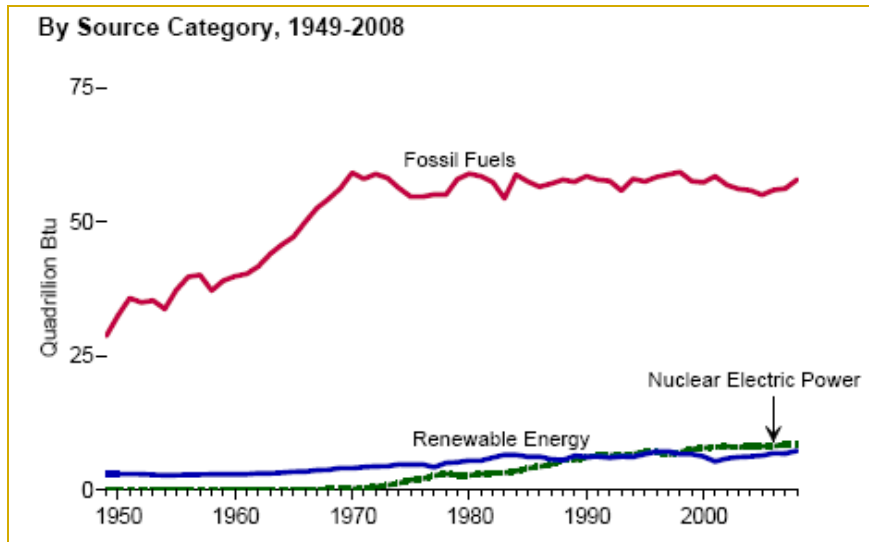


The chart to the left shows the breakout of renewable/sustainable energy consumption. 7% of energy consumed by the US is derived from sustainable energy sources. Included in those sources are solar, geothermal, waste, wind, biofuels, biomass burning (wood), and hydroelectric power. Hydroelectric power and wood have been used for the longest time so they account for the largest share. However, biofuels and modern windmill technology wind have been increasing substantially over the past few years.

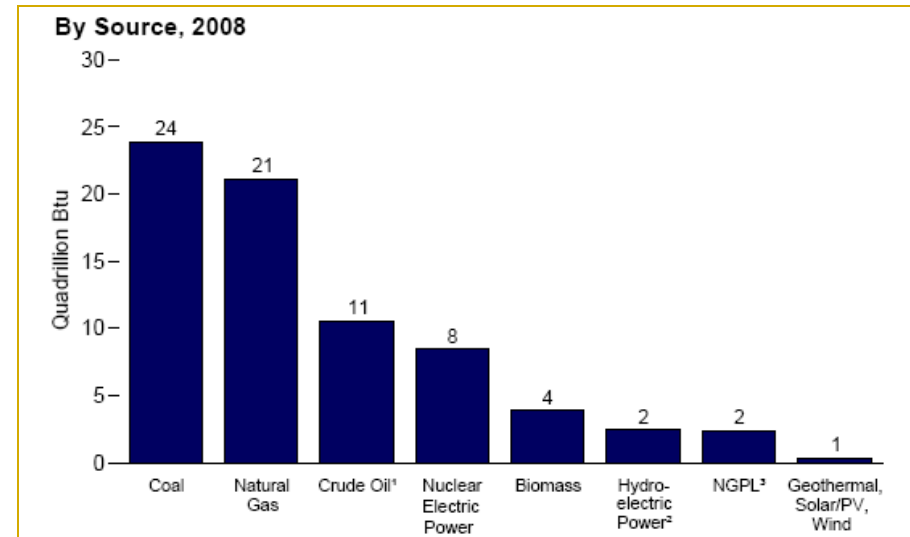
Energy Production in the United States - Overview

While the United States may be a large consumer of energy, it's also a large producer. The good news is that US geology and topology provides access to all kinds of energy. The bad news is that currently most of the energy produced is from fossil fuels.

PRIMARY ENERGY PRODUCTION



This line graph shows that—through the course of history—the USA has relied on fossil fuels as the primary source of energy. Reliance on nuclear energy has been nearly constant over the past 20 to 30 years. However, although nuclear power reduces emissions, it is non-renewable.

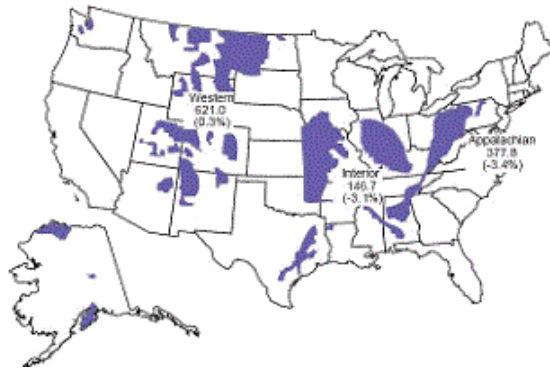


Of the fossil fuels, the USA produces the most energy with coal. Of renewable energy sources, the US produces the most energy with biomass. Although the USA produces only a small amount of wind energy compared to others sources—as of 2009—USA is the world leader in wind energy production.

Energy Production in the United States – Fossil Fuels

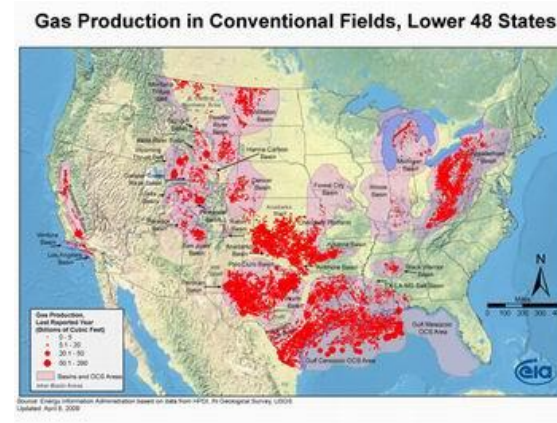
These maps show where the primary fossil fuel production resides in the United States. Take a close look at California, Illinois, Pennsylvania, Texas, and Washington. The student activity will discuss these specific states.

Coal



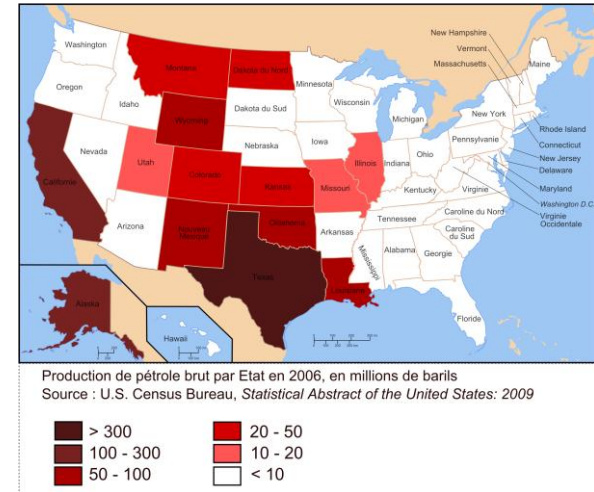
Wyoming is the state producing the most coal. Northeastern Pennsylvania has one of the biggest deposits of anthracite coal. West Virginia, Illinois, Kentucky and Montana also have large coal reserves.

Natural Gas



Most natural gas resides in geographical areas called basins. States located on major basins have access to high levels of natural gas reserves. The map shows Texas has a very high concentration of natural gas, along with the Gulf of Mexico.

Oil (Petroleum)

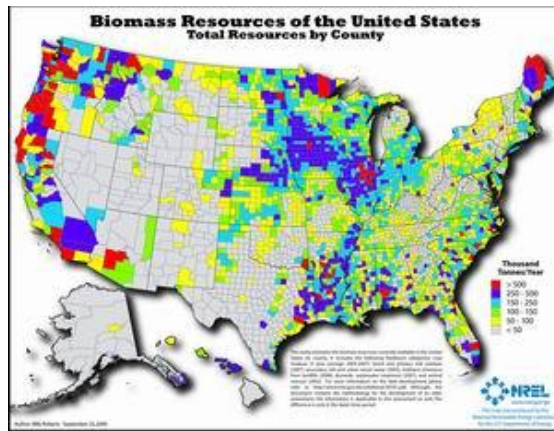


Natural gas and oil are produced in similar areas because their deposits formed in a related way. Onshore oil production is the greatest in Texas, followed by Alaska and California. The Gulf of Mexico is a significant contributor to offshore oil production.

Energy Production in the United States – Renewable Energy Sources

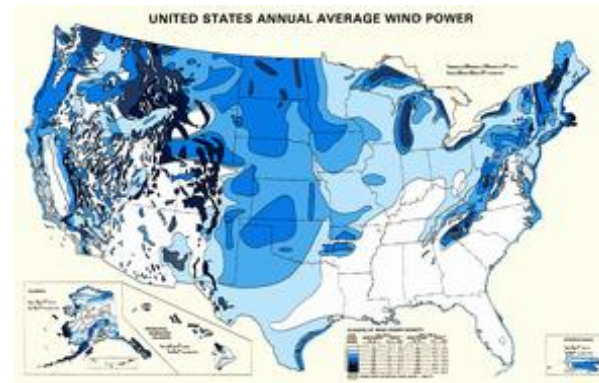
These maps show where the primary renewable energy resources reside in the United States. Take a close look at California, Illinois, Pennsylvania, Texas, and Washington. The student activity will discuss these specific states.

Biomass



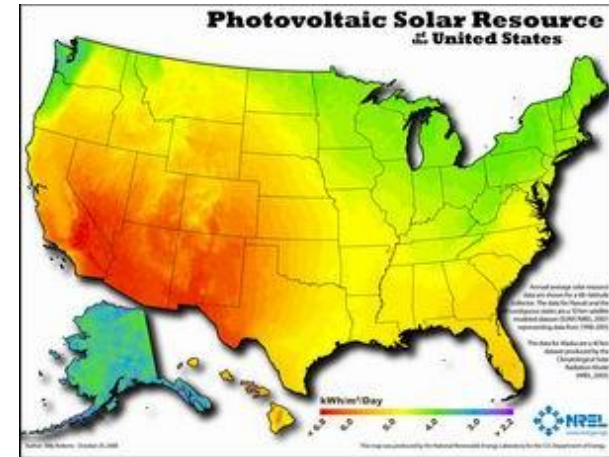
The West Coast of the USA has a significant amount of biomass resources. The term biomass can include many things. The data in this map accounts for: crop and forest residues, primary and secondary mill residues, and urban wood waste. It also includes methane emissions coming from manure, landfills, and wastewater treatment.

Wind



U.S. wind capacity is growing, more than doubling in only three years. The world's largest wind farm operates in Texas. The state of Texas contributes the most US wind energy followed by Iowa, California, and Washington. Many other states have projects underway or under consideration.

Solar



California and the Southwest are the main solar energy contributors. California has the largest *concentrating solar power* plant. In fact, the SEGS plants in California comprise the world's largest plant of its kind. Arizona and Nevada also have this type of plant. Florida has the largest *photovoltaic solar power* plant; Nevada has the second largest. Even the cloudiest places (other than Alaska) have almost half the solar resources as the sunniest.

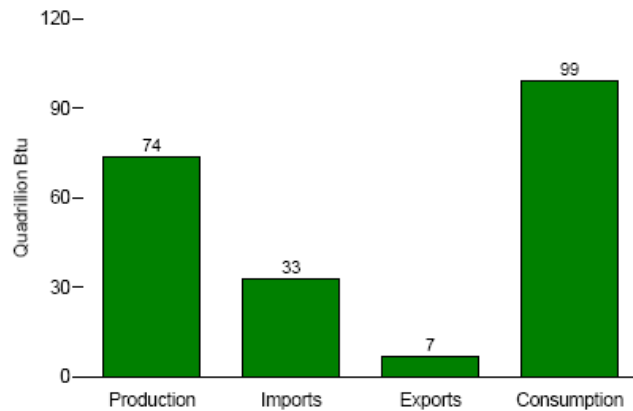
DID YOU KNOW?

The state of Washington produces the majority of its electricity from renewable resources. Check out the maps and you'll see why. It's a great resource for biomass and wind energy, and it's an above average resource for solar energy.

Energy Imports in the United States

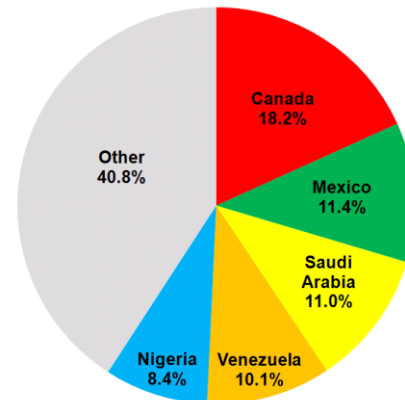
If you compare the energy produced by the United States with the energy consumed, the USA is over 70% self-sufficient. In order to become energy independent, the USA needs to take a major step in reducing our need for foreign oil.

Overview, 2008



Natural gas is the second biggest import behind oil. Imports of natural gas were relatively stable from 1970 to 1986. Since then, the USA has needed to import a rising amount of natural gas. The great majority of gas imports come by pipeline from Canada. The small remainder comes in liquefied form on tankers from a few different overseas countries.

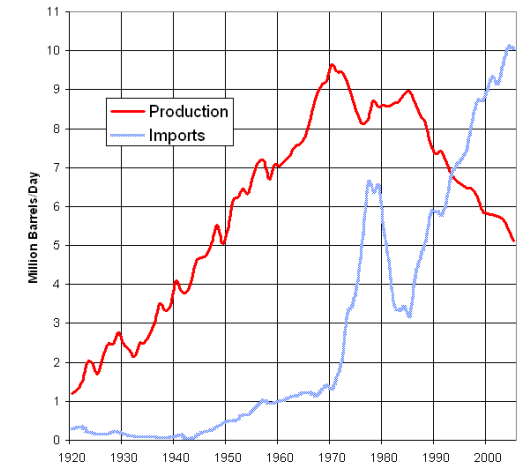
US Petroleum Imports 2007
by Country of Origin



Data source: US Energy Information Administration

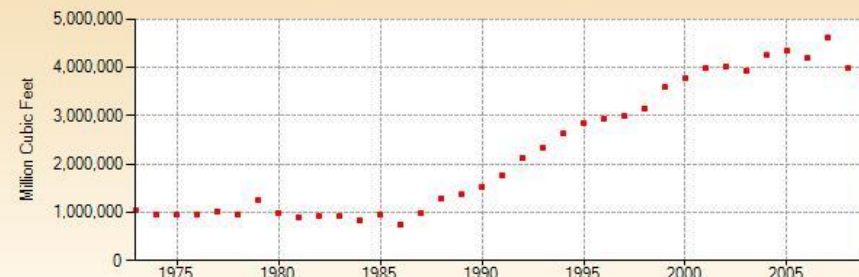
The USA relies heavily on foreign oil for meeting energy needs in transportation and electricity. Because there is a global oil market, prices and availability do not depend on individual countries, but only on the global rate of supply and demand.

US Oil Production and Imports



Despite being the third largest producer of oil in the world, the USA produces only 40% of the oil it needs. In 1970, US oil production peaked. In the early 1990s, oil imports surpassed domestic oil production.

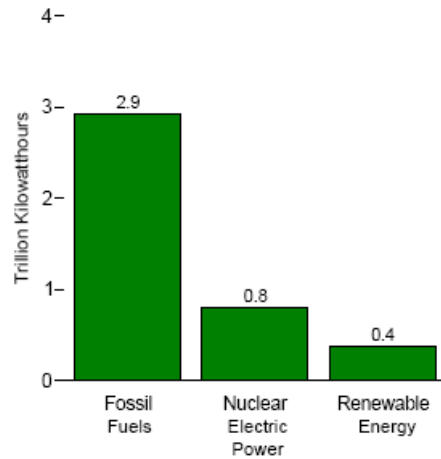
Annual U.S. Natural Gas Imports



Source: U.S. Energy Information Administration

Electricity Generation in the United States

By Source Category, 2008



FOSSIL FUELS: The USA has always relied on coal as the primary source of electricity generation. Today, coal accounts for about half of all electricity generated. Coal—along with the other fossil fuels of natural gas and oil—is easily burned to create steam to turn turbines. This method generates a stable and continuous generation of electricity and has been relied on for decades.

NUCLEAR POWER: Nuclear power was not commercially available until the 1950s. Although nuclear fission is another continuous energy source that can turn turbines, nuclear power has slowly grown over the past 40 years because building nuclear power plants is expensive. Today, USA relies on nuclear energy for about 20% of its electricity generation. On average, however, in certain regions the proportion is much higher (e.g. Illinois >50%).

RENEWABLE ENERGY: Since 2006, renewable energy sources are generating an increasing amount of electricity. Wind and solar energy are strong contributors. Their contributions are expected to continue increasing. However, it is difficult for such sources to compete with coal and nuclear plants since the sun and the wind cannot produce electricity continuously.

By Major Sources, 1949-2008

