Petroleum

Petroleum at a Glance, 2011

Classification:
- nonrenewable

Major Uses:
- transportation, industry

U.S. Energy Consumption:
- 33.689 Q
- 34.67%

U.S. Energy Production:
- 14.049 Q
- 17.99%

What Is Petroleum?

Petroleum is a **fossil fuel**. It is called a fossil fuel because it was formed from the remains of tiny sea plants and animals that died hundreds of millions of years ago, before dinosaurs lived. When the plants and animals died, they sank to the bottom of the oceans. They were buried by thousands of feet of sediment and sand that turned into rock.

Over time, this organic mixture was subjected to enormous pressure and heat as the layers increased. The mixture changed chemically, breaking down into compounds made of hydrogen and carbon atoms—**hydrocarbons**. Finally, an oil-saturated rock—much like a wet household sponge—was formed.

All organic material buried underground does not turn into oil. Certain geological conditions must exist within the rock formations for the transformations to occur. First, there must be a trap of non-porous rock that prevents the material from seeping out, and a seal (such as salt or clay) to keep the material from rising to the surface. Even under these conditions, only about two percent of the organic material is transformed into oil.

A typical petroleum reservoir is mostly sandstone or limestone in which oil is trapped. The oil in it may be as thin as gasoline or as thick as tar. It may be almost clear or black. Petroleum is called a **nonrenewable** energy source because it takes millions of years to form. We cannot make more oil in a short time.

History of Oil

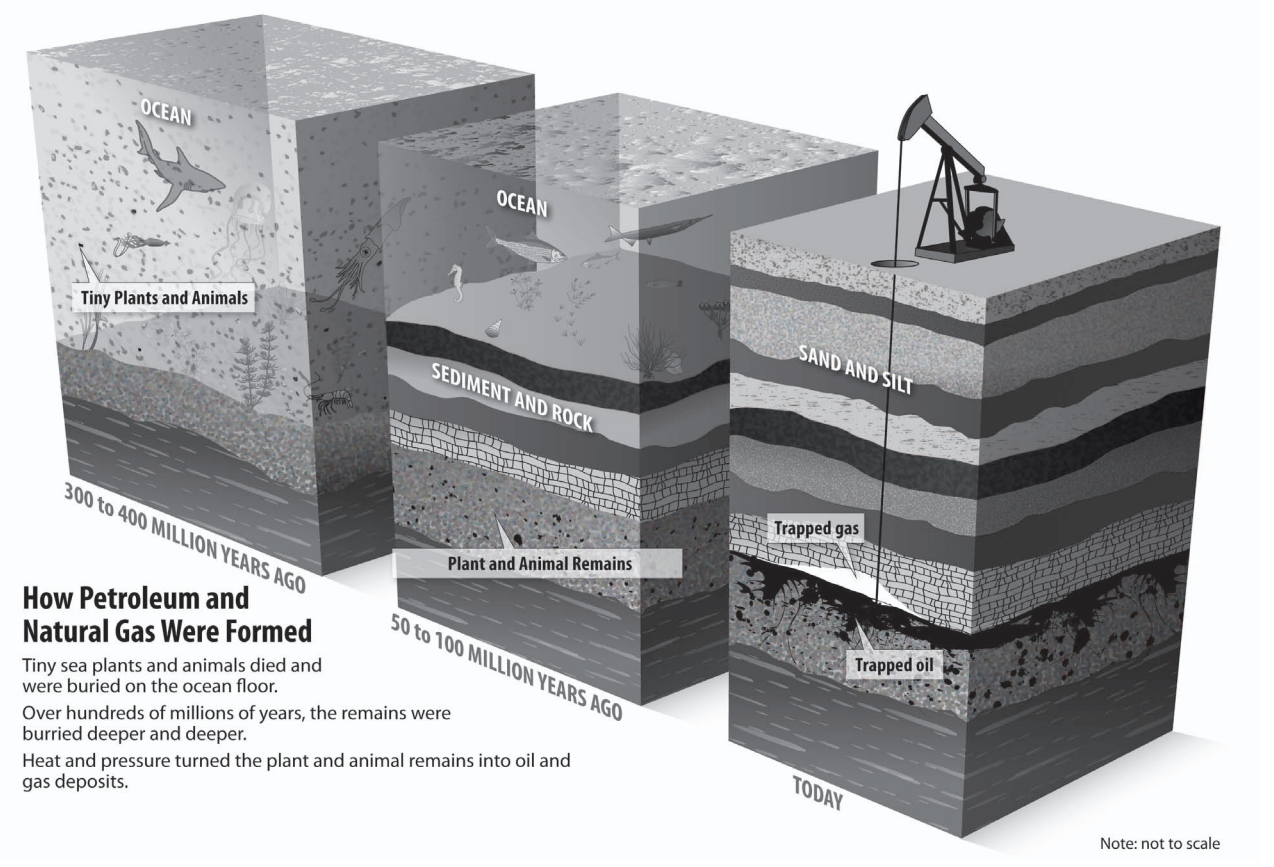
People have used naturally available **crude oil** for thousands of years. The ancient Chinese and Egyptians, for example, burned oil to produce light.

Before the 1850s, Americans often used whale oil for light. When whale oil became scarce, people began looking for other oil sources. In some places, oil seeped naturally to the surface of ponds and streams. People skimmed this oil and made it into **kerosene**. Kerosene was commonly used to light America's homes before the arrival of the electric light bulb.

As demand for kerosene grew, a group of businessmen hired Edwin Drake to drill for oil in Titusville, PA. After much hard work and slow progress, he discovered oil in 1859. Drake's well was 69.5 feet deep, very shallow compared to today's wells.

Drake refined the oil from his well into kerosene for lighting. **Gasoline** and other products made during refining were simply thrown away because people had no use for them.

In 1892, the horseless carriage, or automobile, solved this problem since it required gasoline. By 1920, there were nine million motor vehicles in this country and gas stations were opening everywhere.



Producing Oil

Although research has improved the odds since Edwin Drake's days, petroleum exploration today is still a risky business. Geologists study underground rock formations to find areas that might yield oil. Even with advanced methods, only 61 percent of exploratory wells found oil in 2010. Developmental wells fared much better; 91 percent found oil.

When the potential for oil production is found on shore, a petroleum company brings in a 50 to 100-foot **drilling rig** and raises a **derrick** that houses the drilling tools. Today's oil wells average over 6,000 feet deep and may sink below 20,000 feet. The average well produces 10.6 barrels of oil a day.

To safeguard the environment, oil drilling and oil production are regulated by state and federal governments. Oil companies must get permission to explore for oil on new sites. Experts believe that much of our remaining oil reserves are on land owned by the federal government. Oil companies lease the land from the federal government, which, in return, receives rental payments for the mineral rights as well as percentage payments from each barrel of oil.

Texas produces more oil than any other state. The other top producing states are Alaska, California, North Dakota, and Oklahoma. These five states account for about 56 percent of all U.S. crude oil production. In all, 31 states produce petroleum.

From Well to Market

We cannot use crude oil in the state it's in when it comes out of the ground. The process is a little more complicated than that. So, how does thick, black crude oil come out of the ground and eventually get into your car as a thin, amber-colored liquid called gasoline?

Oil's first stop after being pumped from a well is an oil refinery. A **refinery** is a plant where crude oil is processed. Sometimes, refineries are located near oil wells, but usually the crude oil has to be delivered to the refinery by ship, barge, pipeline, truck, or train.

After the crude oil has reached the refinery, huge round tanks store the oil until it is ready to be processed. **Tank farms** are sites with many storage tanks.

An oil refinery cleans and separates the crude oil into various fuels and by-products. The most important one is gasoline. Some other petroleum products are diesel fuel, heating oil, and jet fuel.

Refineries use many different methods to make these products. One method is a heating process called **distillation**. Since oil products have different boiling points, the end products can be distilled, or separated. For example, asphalts have a higher boiling point than gasoline, allowing the two to be separated.

Refineries have another job. They remove contaminants from the oil. A refinery removes sulfur from gasoline, for example, to increase its efficiency and to reduce air pollution.

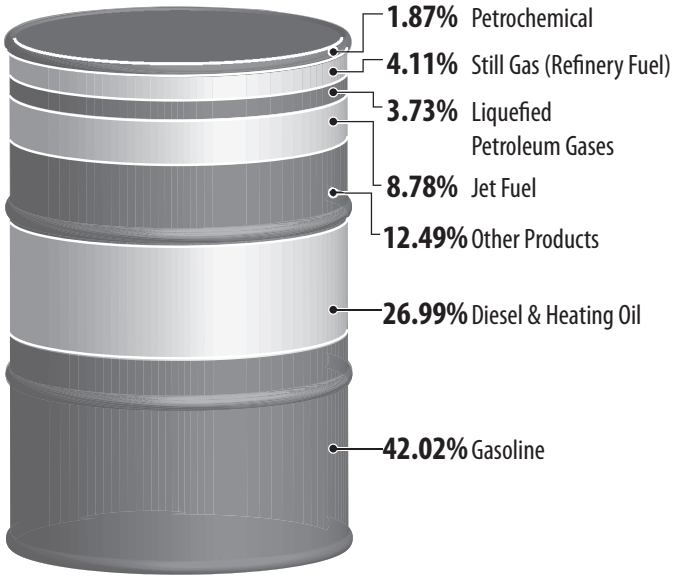
Not all of the crude oil sent to a refinery is turned into product. Up to nine percent of the energy in the crude oil is used to operate the refinery facility.

Shipping Oil Products

Pipelines are the safest and cheapest way to move large quantities of crude oil or refined petroleum across land. About 95,000 miles of small gathering lines and large trunk lines move crude oil from wells to refineries.

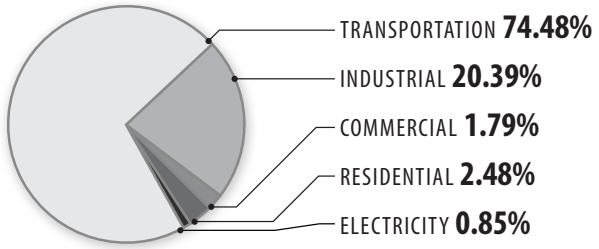
Pump stations, which are spaced 20 to 100 miles apart along the underground pipelines, keep the petroleum products moving at a speed of about five miles per hour. At this rate, it takes two weeks to move a shipment of gasoline from Houston, TX to New York City. Petroleum is transported over water via tanker.

Products Produced From a Barrel of Oil, 2011



* Total does not equal 100% due to independent rounding.
Data: Energy Information Administration

Petroleum Consumption by Sector, 2011



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Data: Energy Information Administration

Distribution

Companies called **jobbers** handle the wholesale distribution of oil. They sell just about everything that comes out of a barrel of crude oil. Jobbers fill bulk orders for petroleum products from gasoline stations, industries, utility companies, farmers, and other consumers.

The retailer is the next link in the chain. A retailer may be a gasoline station or a home heating oil company. The last link is when you pump gasoline into your car, and the engine converts the gasoline's chemical energy into motion to move your car.

Petroleum

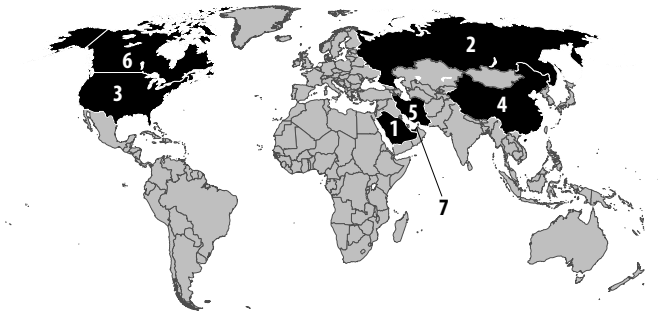
Demand for Oil

Since World War II, petroleum has replaced coal as the leading source of energy consumed in the United States. Petroleum supplies 34.67 percent of the total energy demand. Natural gas supplies 25.57 percent and coal supplies 20.22 percent of our total energy needs.

America uses about 18.8 million barrels of oil (more than 847 million gallons) every day of the year. And experts say we will be using more oil, especially for transportation, in the coming years.

Even now, we use about 46 percent more oil than we did in 1973, when the first oil crisis hit the U.S. This is true even though today's vehicles get almost twice as many miles per gallon as their 1970s counterparts, because there are almost twice as many vehicles on the road today than in 1973. Today, 74.48 percent of U.S. oil consumption is used for transportation.

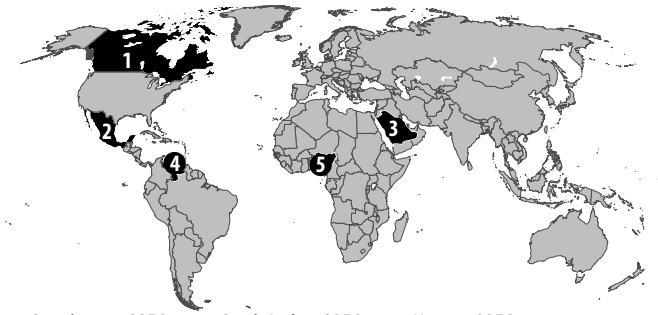
Top Oil Producing Countries, 2011



1. Saudi Arabia
2. Russia
3. United States
4. China
5. Iran
6. Canada
7. United Arab Emirates

Data: Energy Information Administration

Top Sources of U.S. Imported Oil, 2011



1. Canada, non-OPEC
2. Mexico, non-OPEC
3. Saudi Arabia, OPEC
4. Venezuela, OPEC
5. Nigeria, OPEC

Percentage of Imports from Persian Gulf: 16.4%
Percentage of Imports from OPEC Nations: 39.9%

Data: Energy Information Administration

Imported Oil

The United States uses more petroleum than it produces. Today, we import about 45 percent of our crude oil supply from other countries.

Many Americans believe this dependence on imported petroleum is problematic and reduces America's energy security and the ability to withstand disruption of supply. We were first alerted to that reality in 1973 when a group of Arab countries stopped supplying oil (called an embargo) to the United States. These countries belonged to an international trade group called the Organization of Petroleum Exporting Countries or **OPEC** for short. OPEC member countries often set production levels for petroleum. As a rule, the less oil they produce, the higher the price of oil on the world market.

The next shock came in 1978–1979 when the Iranian Revolution cut off oil production. Again, world oil prices increased. Another major price increase resulted from the Persian Gulf War in 1990–1991. As many countries in the Middle East and North Africa experience political change, petroleum prices may increase temporarily resulting in higher prices for gasoline and other products. Many people believe that prices are less related to oil supply and more related to how petroleum is traded (bought and sold) as a commodity.

The U.S. continues to work to increase energy security and maintain domestic supplies of petroleum—including the purchase and storage of three months of supply in the Strategic Petroleum Reserve (SPR). Established in 1975, the SPR is only to be tapped during an energy emergency. The SPR was first used in January 1991, during the Persian Gulf War.

The United States also imports oil from non-OPEC countries. Today, we import more oil from Canada than any other country (24 percent) followed by Mexico (11 percent). The United States is a major consumer in a global energy economy and access to petroleum resources continues to be a high priority for providing the energy resources needed for transportation and for making many of our consumer goods and products. As countries like China and India grow, their demand for petroleum and petroleum products increases as well. Global demand for oil continues.

There are steps we can take to help ensure our energy security and reduce the impact of high oil prices. Some experts believe the most important step is to decrease our demand for oil through increased conservation—reducing the oil we use and increasing the efficiency of our vehicles and transportation.

Some people believe we should increase oil production in the United States, particularly in the Arctic National Wildlife Refuge (ANWR) in northern Alaska and in offshore areas. Others say we should increase our use of other transportation fuels. Many people agree that the United States must increase production from domestic sources, increase efficiency, and continue development of non-petroleum transportation fuels.

Offshore Oil Reserves

There are rich deposits of petroleum and natural gas on the **outer continental shelf (OCS)**, especially off the Pacific coasts of California and Alaska and in the Gulf of Mexico. Thirty basins have been identified that could contain enormous oil and gas reserves. It is estimated that 30 percent of undiscovered U.S. gas and oil reserves are contained in the OCS.

Today, there are more than 4,000 drilling platforms, servicing thousands of wells. OCS production supplies approximately 13 percent of the nation's natural gas production and 33 percent of its oil production. Most of the active wells are in the central and western Gulf of Mexico, with additional wells off the coast of California.

Although there are no producing wells in other areas, there is believed to be significant oil potential in the Beaufort Sea off Alaska, as well as natural gas potential in the Eastern Gulf of Mexico and in certain basins off the Atlantic Coast.

The U.S. Department of Interior (DOI) grants permission to use offshore lands through lease sales. After companies pay for a lease, they apply for U.S. DOI permits to develop energy resources from the lease. A lease is generally nine square miles. Currently, the entire Pacific Coast, the eastern Gulf of Mexico, the entire Atlantic Coast, and parts of Alaska are restricted from new lease sales, due to a Presidential mandate through 2017. Leases and new production can still occur in unblocked areas.

Offshore Production

Offshore production is costly—many times more expensive than land-based production. To reach oil buried in shallow water, drilling platforms stand on stilt-like legs that are imbedded in the ocean floor. These huge platforms hold all the drilling equipment needed, as well as housing and storage areas for the work crews. Once the well has been drilled, the platforms also hold the production equipment.

Floating platforms are used for drilling in deeper waters. These self-propelled vessels are anchored to the ocean bottom with huge cables. Once the wells have been drilled from these platforms, the production equipment is lowered to the ocean floor and sealed to the well casings to prevent leakage. Wells have been drilled in 10,000 feet of water using these floating rigs.

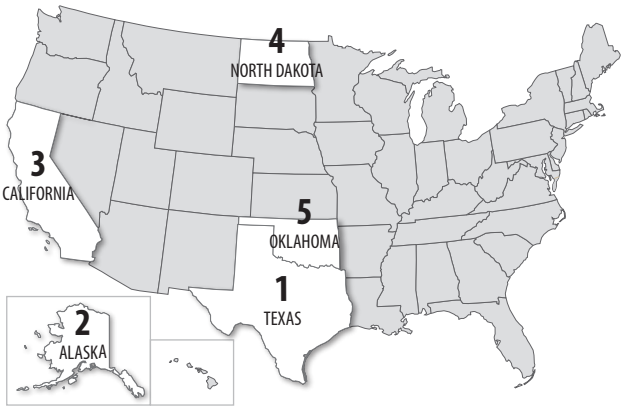
In 2010, the Macondo (Deepwater Horizon) well accident released oil into the Gulf of Mexico for several months. The companies involved in developing Macondo, the Coast Gaurd, and the Bureau of Ocean Energy Management, Regulation and Enforcement quickly began work to determine the cause of the accident and to improve production and safety standards as a result.

Oil Prices

Most of the world moves on petroleum—gasoline for cars, jet fuel for planes, and diesel fuel for trucks. Then there are the petroleum products needed to run factories and manufacture goods. That's why the price of oil is so important. In 1998, the average price of a barrel of oil dropped as low as $11 a barrel; in the spring and summer of 2008, the price shot up to over $130 a barrel, the highest price in history.

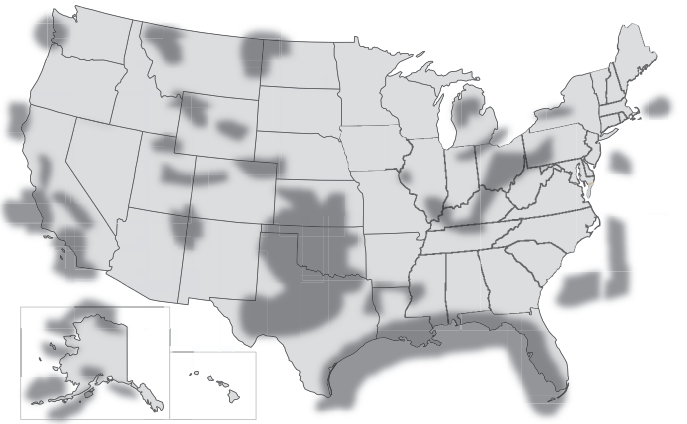
Low oil prices are good for the consumer and the economy, acting as a check on inflation. The oil industry, however, does not prosper during periods of low oil prices. Oil industry workers lose their jobs, many small wells are permanently sealed, and the exploration for new oil sources drops off. Low oil prices have another side effect. People use more petroleum products when crude oil is cheap. They buy bigger cars and drive more miles. Urban air quality suffers. With the recent return of high oil prices, the sale of large cars and SUVs has decreased dramatically.

Top Petroleum Producing States, 2011



Data: Energy Information Administration

U.S. Oil and Gas Basins



Data: Energy Information Administration

Oil and the Environment

In the United States, we use more petroleum than any other energy source. Petroleum products—gasoline, fertilizers, plastics, medicines—have brought untold benefits to Americans and the rest of the world. We depend on these products, and, as consumers, we demand them. Petroleum production, distribution, and consumption can also contribute to air and water pollution.

Drilling for and transporting oil can endanger wildlife and the environment if it spills into rivers or oceans. Leaking underground storage tanks can pollute groundwater and create noxious fumes. Processing oil at the refinery can contribute to air and water pollution. Burning gasoline to fuel our cars contributes to air pollution. Even the careless disposal of waste oil drained from the family car can pollute rivers and lakes.

Many advances have been made in protecting the environment since the passage of the Clean Air Act in 1970. Oil companies have redesigned their refineries to reduce emissions into the air and water. Gasolines have been reformulated to burn cleaner, dramatically cutting the levels of lead, nitrogen oxide, carbon monoxide, and hydrocarbons released into the air.

The production, transportation, distribution, and consumption of petroleum are strictly regulated to minimize the negative effects on the environment. Our increasing dependence on petroleum presents a continuing challenge. The future must balance the growing demand for petroleum products with protection of the global environment.