

Fossil fuels: A story of great power but also problems with pollution

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Big Bend Power Station is a coal-fired power plant near Apollo Beach, Florida.

A fossil fuel is a natural substance formed from the buried remains of ancient organisms that can be used as a source of energy. Fossil fuels formed over millions of years as heat and pressure from layers of sediment changed the decayed organic remains into materials such as coal and petroleum. The energy in fossil fuels is the energy from sunlight stored in the tissues of the buried organisms as a result of photosynthesis.

Fossil fuel usage has steadily increased since the Industrial Revolution. At the start of the 21st century, fossil fuels comprised nearly 90 percent of the world's energy supplies. However, fossil fuels are nonrenewable resources. Because it takes millions of years for fossil fuels to form, they cannot be replaced when they are used.

Fossil fuels may be solids, liquids, or gases. All fossil fuels are hydrocarbons, a class of chemicals composed only of carbon and hydrogen atoms. Coal, petroleum, and natural gas are the most commonly known fossil fuels.

Coal

Coal is the most widely used of the solid fossil fuels. Most coal formed from plants that grew in or near swamps in warm, humid regions of the Earth during the Carboniferous Period (about 359 to 299 million years ago). Dead plant matter fell into the swamps and settled at the swamp bottom, forming a thick layer of decaying plant material. Over millions of years, sediment covered and compressed the decaying plant matter, forming peat.

The pressure and heat of more sediment layers changed the peat into lignite, a soft coal. Continued heat and pressure on the lignite changed it into harder forms of coal. Anthracite, the hardest coal, was the last to form. Hard coals are considered the best energy sources among the coals because they burn the hottest and cleanest.

Petroleum And Natural Gas

Petroleum and natural gas are the most common liquid and gaseous fossil fuels, respectively. Petroleum is often called crude oil or simply oil. Although the term petroleum is often used to refer to the liquid form, as a technical term it also includes natural gas.

Most of the world's large natural gas and oil deposits formed during the Carboniferous Period. Oil and gas formed through a similar process, often in the same swampy location, from the buried remains of tiny aquatic organisms such as algae, diatoms, and zooplankton. As these organisms died and sank to the muddy bottom, decomposition and other changes gradually changed their buried remains into a substance called kerogen. Over millions of years, increasing heat and pressure from more sediment layers transformed the kerogen into petroleum. Depth and temperature determined whether the petroleum was liquid or gaseous, with natural gas forming at deeper and hotter locations.

The main liquid fossil fuels used today are refined products of oil. These include gasoline, fuel oils such as diesel and jet fuel, and furnace oils for home heating. Kerosene, once widely used to provide light, is still used in many places for cooking and space heating. It also is the main fuel for modern jet engines.



Natural gas is used for heating and cooking in the home and for industrial heating. Natural gas produces no smoke and leaves no ash behind. Because it is a fairly clean energy source, natural gas is often a preferred fuel for environmental reasons.

Other Fossil Fuels

Peat and coke are solid fossil fuels that are commonly used today. Peat is used as a heating fuel in areas where other fuels are not available. It is not an efficient fuel because it burns slowly, producing much smoke and little heat. Coke is a residue that remains after gases and tar are extracted from some types of coal. It is useful in industry because it produces intense heat without smoke. Coke is widely used in blast furnaces to make iron and in other metallurgical processes.

As fossil fuel reserves become depleted, the search for alternative fuel sources has increased. Two such resources are oil shale and tar sands. Oil shale is a type of rock that contains embedded oils. Tar sands are rocks that contain heavy, tar-like hydrocarbons within the rock.

Extracting useful substances from these resources has historically been difficult and costly, making these resources an impractical fuel option at present until recent years when technology improved.

Where Fossil Fuels Are Found

Fossil fuels are not distributed evenly across the Earth. The United States, Russia, and China have the largest coal deposits in the world. Sizable deposits also are located in Australia, India, and South Africa.

More than half of the world's known oil and natural gas reserves are located in the Middle East. This means that the Middle East contains more oil than the rest of the world combined, followed by Canada and the United States, Latin America, Africa, and parts of Russia, Transcaucasia, and Central Asia. Each of these regions contains less than 15 percent of the world's proven reserves.

Disadvantages Of Fossil Fuels

Two main disadvantages of fossil fuels are their limited supply on Earth and the environmental harm they cause. Burning petroleum and coal releases harmful gases such as carbon monoxide, nitrogen oxide, and sulfur dioxide. These gases pollute the air and react with moisture in the atmosphere to create acid rain.

Scientific evidence shows that burning fossil fuels emits more carbon dioxide into the atmosphere. Over many years, the buildup of this carbon dioxide increases atmospheric temperatures. This warming of Earth's atmosphere, called the greenhouse effect, contributes to climate change, a serious environmental concern.

These problems have led scientists and engineers to develop new ways to generate power without using fossil fuels. For example, some cars are now powered by electricity instead of gasoline. Homes can be heated using solar or geothermal energy. Some electric power plants run on nuclear energy, water power, or wind power.

These alternative energy sources are forms of renewable resources because — unlike fossil fuels — they cannot be depleted. In addition, they do not emit carbon dioxide or other greenhouse gases. Replacing fossil fuel-powered engines and power plants with renewable energy could limit the damage of climate change on the environment.