**Coal Basics**

**Coal takes millions of years to form**

Coal is a combustible black or brownish-black sedimentary rock with a high amount of carbon and hydrocarbons. Coal is classified as a nonrenewable energy source because it takes millions of years to form. Coal contains the energy stored by plants that lived hundreds of millions of years ago in swampy forests. The plants were covered by layers of dirt and rock over millions of years. The resulting pressure and heat turned the plants into a substance now known as coal.

**Mining coal**

**Coal miners use two primary methods to remove coal:**

*Surface mining* is used to produce most of the coal in the United States because the method is less expensive than underground mining. Surface mining can be used when the coal is less than 200 feet underground. In surface mining, large machines remove the top soil and layers of rock known as overburden to expose the coal seam. *Mountaintop removal* is a form of surface mining where the tops of mountains are dynamited and removed to access coal seams. After the mining is finished, the disturbed area is covered with topsoil, and the area is replanted.

*Underground mining*, sometimes called deep mining, is used when the coal is several hundred feet below the surface. Some underground mines are 1,000 feet deep, and extend for miles. Miners ride elevators down deep mine shafts and travel on small trains in long tunnels to get to the coal. The miners use large machines that dig out the coal.

**Uses of Coal**

About 93% of the coal consumed in the United States is used in the electric power sector. The remaining 7% of coal is used as a basic energy source in many industries including the steel, cement, and paper industries.

Coal is used to create about 39% of all the electricity generated in the United States. Power plants can make steam by burning coal. The steam then turns turbines (machines for generating rotary mechanical power) to generate electricity. In addition to companies in the electric power sector, industries and businesses with their own power plants use coal to generate electricity.

**Coal & the Environment**

Coal is an abundant fuel source that is relatively inexpensive to produce and convert to useful energy. However, producing and using coal has many impacts on the environment.

**Impacts of coal mining**

Surface, or strip mines are the source of about 66% of the coal that is mined in the United States. These mining operations remove the soil and rock above coal deposits, or *seams*.

Mountaintop removal and valley fill mining has affected large areas of the Appalachian Mountains in West Virginia and Kentucky. In this form of extraction the tops of mountains are removed using a combination of explosives and mining equipment and are then deposited into nearby valleys. The water draining from these filled valleys may contain pollutants that can harm aquatic wildlife downstream. While mountaintop mining has existed since the 1970s, its use became more widespread and controversial beginning in the 1990s. U.S. laws require that dust and water runoff from areas affected by coal mining operations must be controlled, and that the area has to be *reclaimed* close to its original condition.

Underground mines have less of an impact on the environment compared to surface mines. The largest impact of underground mining may be the methane gas that must be vented out of mines to make the mines a safe place to work. Methane is a strong greenhouse gas. In 2012, methane emissions from active and abandoned underground mines accounted for about 8% of total U.S. methane emissions and 1% of total U.S. greenhouse gas emissions (based on global warming potential). Some mines capture and use or sell the methane extracted from mines. Surface mines contributed about 1% of total U.S. methane emissions.

The ground above mine tunnels can also collapse, and acidic water can drain from abandoned underground mines.

**Emissions from burning coal**

In the United States, most of the coal consumed is used as a fuel to generate electricity. Burning coal produces emissions that adversely affect the environment and human health.



There are several principal emissions resulting from coal combustion:

* Sulfur dioxide (SO2), which contributes to acid rain and respiratory illnesses
* Nitrogen oxides (NOx), which contribute to smog and respiratory illnesses
* Particulates, which contribute to smog, haze, and respiratory illnesses and lung disease
* Carbon dioxide (CO2), which is the primary greenhouse gas emission produced from the burning of fossil fuels (coal, oil, and natural gas)
* Mercury and other heavy metals, which have been linked with both neurological and developmental damage in humans and other animals. Mercury concentrations in the air usually are low and of little direct concern. However, when mercury enters water—either directly or through deposition from the air—biological processes transform it into methylmercury, a highly toxic chemical that accumulates in fish and the animals (including humans) that eat fish.
* Fly ash and bottom ash, which are residues created when coal is burned at power plants. In the past, fly ash was released into the air through the smokestack, but laws now require that much of fly ash now captured by pollution control devices, like scrubbers. In the United States, fly ash is generally stored at coal power plants or placed in landfills. Pollution leaching from ash storage and landfills into groundwater and the rupture of several large impoundments of ash are environmental concerns.

Reducing the environmental impacts of coal use

The Clean Air Act and the Clean Water Act require industries to reduce pollutants released into the air and water.

Industry has found several ways to reduce sulfur, NOx, and other impurities from coal. They have found more effective ways of cleaning coal after it is mined, and coal consumers have shifted toward greater use of low sulfur coal.

Power plants use *scrubbers*, to clean sulfur from the smoke before it leaves their smokestacks. In addition, industry and the U.S. government have cooperated to develop technologies that can remove impurities from coal or that can make coal more energy-efficient so less needs to be burned.

Equipment intended mainly to reduce SO2, NOx, and particulate matter can also be used to reduce mercury emissions from some types of coal. Scientists are also working on new ways to reduce mercury emissions from coal-burning power plants.

Research is underway to address emissions of carbon dioxide from coal combustion. Carbon capture separates CO2 from emissions sources and recovers it in a concentrated stream. The CO2 can then be sequestered, which puts CO2 into storage, possibly underground, where it will remain permanently.

Reuse and recycling can also reduce coal’s environmental impact. Land that was previously used for coal mining can be reclaimed and used for airports, landfills, and golf courses. Waste products captured by scrubbers can be used to produce products like cement and synthetic gypsum for wallboard.

http://www.eia.gov/kids/energy.cfm?page=coal\_home-basics