



Coal Energy

Harold Schobert
 Director, The Energy Institute
 College of Earth and Mineral Sciences

What is coal?

Coal is a combustible sedimentary rock that contains large amounts of carbon and is the most abundant fossil fuel produced in the United States. Coal is a nonrenewable energy source because it takes millions of years to create. The energy in coal comes from the energy stored by plants that lived hundreds of millions of years ago, when the earth was partly covered with swampy forests. As the plants and other life forms died, they drifted down to the bottom of the swamps, slowly decomposed, and formed peat—a soggy, sponge-like material. The peat became buried and compressed under the earth's surfaces over a long period of time. Over millions of years and through the forces of heat and pressure, the compressed peat became coal.

How is it used?

Over 90 percent of the coal used in the United States is used to generate almost half of all electricity produced. It's also used as a basic energy source in many industries, including, steel, cement and paper. There are four different ranks of coal (lignite, subbituminous, bituminous, anthracite), and each rank has varying amounts of carbon that determines the amount of heat energy it can produce.

In addition, a variety of industries use coal energy and its by-products. Coal is used in making steel, and separated ingredients of coal are used in making plastics, tar, synthetic fibers, fertilizers, and medicines. The concrete and paper industries also burn large amounts



Coal chunks

of coal. In the future, coal may be used in the manufacture of carbon based materials and chemicals.

How is coal obtained?

Coal is mined using two methods: surface and underground mining. Most of the coal beds in the U.S. are less than 200 feet underground, so approximately two-thirds of coal production comes from surface mines. The process involves removing the topsoil and subsoil by machines such as draglines, wheel excavators, and large shovels to uncover the coal. After the coal is removed and loaded into trucks, the area is refilled and covered with the soils that were removed and reseeded. It is less expensive than underground mining, and once the mining is finished, the area can easily be restored to its original condition or improved.

Underground mining, sometimes called deep mining, is used when the coal is buried over 200 feet below the surface. It involves drilling

two openings called shafts into the coal bed—one to transport miners and equipment, and the other to bring coal to the surface. The coal is broken into manageable sizes by various methods.

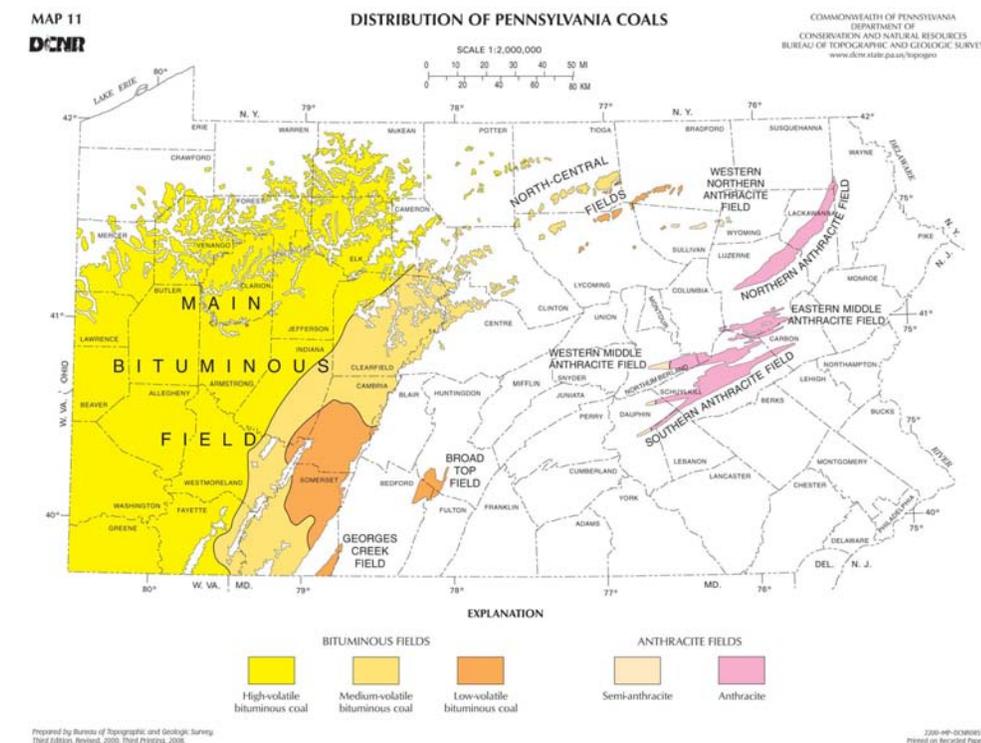
What is its potential for Pennsylvania?

The United States has the world's largest known coal reserves, over 260 billion short tons, which is enough coal to last approximately 225 years at today's usage levels. Pennsylvania is the third-highest coal-producing state, so by using coal heat one can support the local economy. Coal is also the cheapest source of energy per BTUs (British Thermal Unit). Energy experts believe coal is a useful and important source of energy, and that we will continue to rely on coal to supply our energy needs for many years to come. In addition, new technologies are ensuring coal is cleaner burning than in the past.

What issues are limiting its use?

Without proper care, coal mining can destroy land and pollute water. However, environmental laws and modern technologies have greatly reduced coal's impact on the environment. Restoring the land damaged by surface mining is an important part of the mining process. Because mining activities often come into contact with water resources, coal producers must also prevent damage to ground and surface waters.

There are other environmental issues concerning coal use. When coal is burned as fuel, it gives off carbon dioxide, the main greenhouse gas that is linked with global warming. Burning coal also produces other emissions, such as sulfur,



nitrogen oxide, and mercury that can pollute the air and water and produce acid rain. According to EPA data, annual carbon dioxide emissions from coal burning power plants are greater than the emissions from all cars, trucks, planes, trains, and other forms of transportation combined.

The EPA's Clean Air Act (<http://www.epa.gov/air/caa/>) and the Clean Water Act (<http://www.epa.gov/watertrain/cwa/>) require industries to reduce pollutants released into the air and the water. The coal industry has found several ways to reduce sulfur, nitrogen oxides, and other impurities from coal, such as cleaning the coal before it leaves the mine. Power plants use "scrubbers" to clean sulfur from the smoke before it leaves their smokestacks. In addition, industry and government have cooperated to develop "clean coal technologies" that either remove sulfur and nitrogen oxides from coal, or convert coal to a gas or liquid fuel (E&E fact sheet).

Additional Resources

Penn State's Earth and Mineral Sciences Energy Institute
<http://www.energy.psu.edu/>

Penn State's Coal and Coke Heritage Center
<http://www2.fe.psu.edu/coalandcoke/>

DCNR Coal in Pennsylvania Publication
<http://www.dcnr.state.pa.us/topogeo/education/coal/es7.pdf>

EMS Energy Institute Fact Sheets:
<http://www.energy.psu.edu/factsheets.html>