

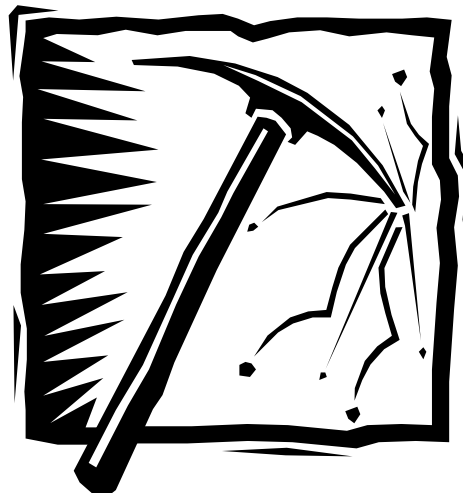
Facts about Coal

Introduction

The United States has more coal than any other fossil fuel resource. Coal is the second most consumed fossil fuel in the world, behind petroleum, (which includes liquids from biomass, crude oil, coal, and natural gas).

Coal is formed from plant matter that decayed in swamps and bogs millions of years ago. Geological processes compressed and altered these plant remains into a solid material made of carbon and other substances, such as hydrogen, oxygen, nitrogen, and sulfur, in other words, it's packed with energy.

There are four main types of coal, which are classified by how much carbon they contain. Anthracite is the hardest and contains the most carbon per pound. Anthracite is followed by bituminous and subbituminous coal. Lignite, a soft coal, has the lowest amount of carbon per pound. The energy content of coal is approximately related to its carbon content. The energy content of coal is measured in Btu (British thermal units) or quads (1,015 Btu).



The table below summarizes the different types of coal in terms of energy, carbon and sulfur content, and percent of known U.S. Reserves.

Coal Types				
Type of Coal	Average Energy Content (Btu per lb.)	Carbon Content (%)	Sulfur Content* (%)	Percentage of Known U.S. Reserves (%)
Anthracite	12,500	86–98	0.4–1.9	1.5
Bituminous	12,000	50–86	0.8–5.0	51.0
Subbituminous	9,000	40–0	0.6–1.8	38.0
Lignite	7,000	40	1.6	9.5

* For selected samples of coal types. Numbers may not cover the complete range of sulfur contained in a given type of coal.

Reserves

As of 2014, the U.S. had 480 billion short tons of known coal reserves. Of this, about 256 billion short tons (53 percent) are mineable. Most known coal reserves are in Wyoming, followed by West Virginia, Kentucky, Pennsylvania, and Illinois. Wisconsin has no known coal deposits. (See **U.S. Coal Deposits**). Based on U.S. coal production in 2013 at 984.8 million short tons, the U.S. estimated recoverable coal reserves would last about 261 years. The actual number of years that those reserves will last depends on changes in production and reserves estimates.

Some refer to the U.S. as the “Saudi Arabia of coal” because it has more than one-fourth of the world’s mineable reserves. Current known world coal reserves are estimated to be 861 billion tons. The biggest mineable reserves can be found in China, the U.S., India, Indonesia, and Russia.

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Mining

Coal is extracted from underground and from surface mines (sometimes called strip mines). Since coal is deposited in broad layers or seams, between 40 and 60 percent of the coal from underground mines must be left behind as pillars to prevent cave-ins and collapse of the surface. Most underground mines are located in the eastern United States.

Coal seams within 300 feet of the surface can be surface mined. Most of the coal produced in the U.S. comes from surface mines, which are often found in the central and western U.S. To mine the coal, the ground above the seams, called overburden, is first removed. After mining, the land is reclaimed; the overburden is put back and the surface is graded to match the original shape of the land (although it will be somewhat lower in elevation) and replanted with the same type of vegetation.

Production

The United States produced 984.8 million short tons of coal in 2013. About 47.8 percent of which is bituminous coal, which is mined mostly in West Virginia, Kentucky, and Illinois. About 44.1 percent is sub-bituminous, mined principally in Wyoming, and 7.8 percent is lignite which is mined chiefly in Texas, North Dakota, and Louisiana. Anthracite is mined only in northeastern Pennsylvania and makes up about 0.2 percent of the US coal production.

In 2013, Wyoming produced most (40 percent) of the nation's coal, providing 388 million tons. West Virginia was the second highest producer at 11 percent while Kentucky produced eight percent. These three states account for 59 percent of total U.S. coal production.

In 2013, world coal production was around 7,823 million tons. China is the highest producer, and together, China and the US produce more than half of the world's coal. Other large coal producers include India, Indonesia, Australia, Russia, South Africa, Germany, Poland, and Kazakhstan.

Processing and Transportation

Coal requires little processing to be used as fuel. Processing includes washing impurities from the coal and then grinding it into fine particles at electric power plants to improve burning.

Sixty-seven percent of US coal is transported either partially or completely by rail in the United States. The balance is moved by river barge, truck, and—for power plants located at the coal mine—by conveyor. Coal slurry, a mix of finely ground coal and water, can also be transported by pipelines, although this is rare.

In Wisconsin, coal shipments are handled at several of the state's ports along the Mississippi River and the Great Lakes. Most of the coal consumed in Wisconsin arrives by rail from Wyoming, and almost all of it is used by the electric power sector to generate electricity. The remaining coal is used by the industrial sector, with only about 0.1 percent being consumed by the commercial sector.

Electricity Production

Coal currently provides 40 percent of the world's electricity needs. Most of the coal produced in the United States is burned in power plants to generate electricity. Wisconsin's electric power plants consume 94 percent of all coal delivered to the state, dominating electricity generation in Wisconsin. In 2013, coal provided 62 percent of the state's net electricity generation.

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Other Uses

Coal is used as a source of energy by industries that manufacture cement, chemicals, paper, and metals. Coal can also be used to produce methane using a process called gasification. There are several gasification plants in the United States.

One percent of the coal consumed in the United States is used for heating homes and commercial businesses. In Wisconsin, virtually no homes (out of more than two million) are still heated with coal. Coal is used to produce coke, a material used to make steel. Roughly 70 percent of global steel production is dependent on coal. Manufacturers also use coal as an ingredient to create photographic film, electrodes, varnishes, perfumes, and inks.

Consumption

During 2013, Americans consumed 924 million short tons of coal. Total coal consumption in Wisconsin was more than 25 million short tons; 94 percent of this was burned in power plants to generate electricity. World consumption of coal was 4,762 million tons. The global coal demand is projected to reach 9 billion tons by 2019.

Effects

The mining and transportation of coal provide jobs. However, conflicts between miners and mine owners and managers have led to numerous strikes throughout the past century and caused supply disruptions within the United States. Underground mining is hazardous because of cave-ins, methane gas explosions, and dust inhalation. Surface mining is safer, although accidents and noise may cause problems. Mine safety has greatly improved during this century.

Coal use has serious environmental drawbacks. Mining can scar the land unless it is carefully reclaimed. Groundwater may become polluted. Surface collapse above old underground mines, called subsidence, is also a potential problem.

Mercury, a toxic, heavy metal, is released into the air when coal is burned. The airborne mercury attaches to water and dust particles and enters lakes and streams in rain, snow, and runoff. Fish absorb mercury through their gills or by ingesting contaminated smaller organisms. Humans may get mercury poisoning by eating contaminated fish. Serious neurological damage, especially to children, has been linked to mercury poisoning.

Compared to other fossil fuels, coal produces the greatest amount of carbon dioxide and solid particles per pound when burned. Carbon dioxide contributes to climate change. Coal burning also produces sulfur dioxide (which leads to acid rain) and nitrogen oxides. Large amounts of ash remain after burning coal and must be disposed of. Some of these air pollutants can be reduced using scrubbers and other pollution control devices. To reduce sulfur dioxide emissions, many electric utilities, including those in Wisconsin, have switched to burning low-sulfur subbituminous coal mined in Wyoming and other western states.

Carbon Capture and Storage (CCS)

Carbon Capture and Storage (CCS) is a technology that can capture up to 90 percent of the carbon dioxide (CO₂) emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing the carbon dioxide from entering the atmosphere. There have been some positive efforts to build more efficient plants, retrofit old plants, and decommission the oldest, least efficient plants. Carbon capture and storage (CCS) is the most promising technology to reach near-zero CO₂ emissions from large CO₂ sources.

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Outlook

At current rates of use, the nation's known mineable coal reserves should last hundreds of years. In the future, coal may be converted into gaseous and liquid fuels, thus supplementing finite supplies of natural gas and oil. However, coal-derived fuels will likely be more expensive. Environmental drawbacks such as acid rain and climate change, along with mining restrictions on protected lands, may limit future coal use.

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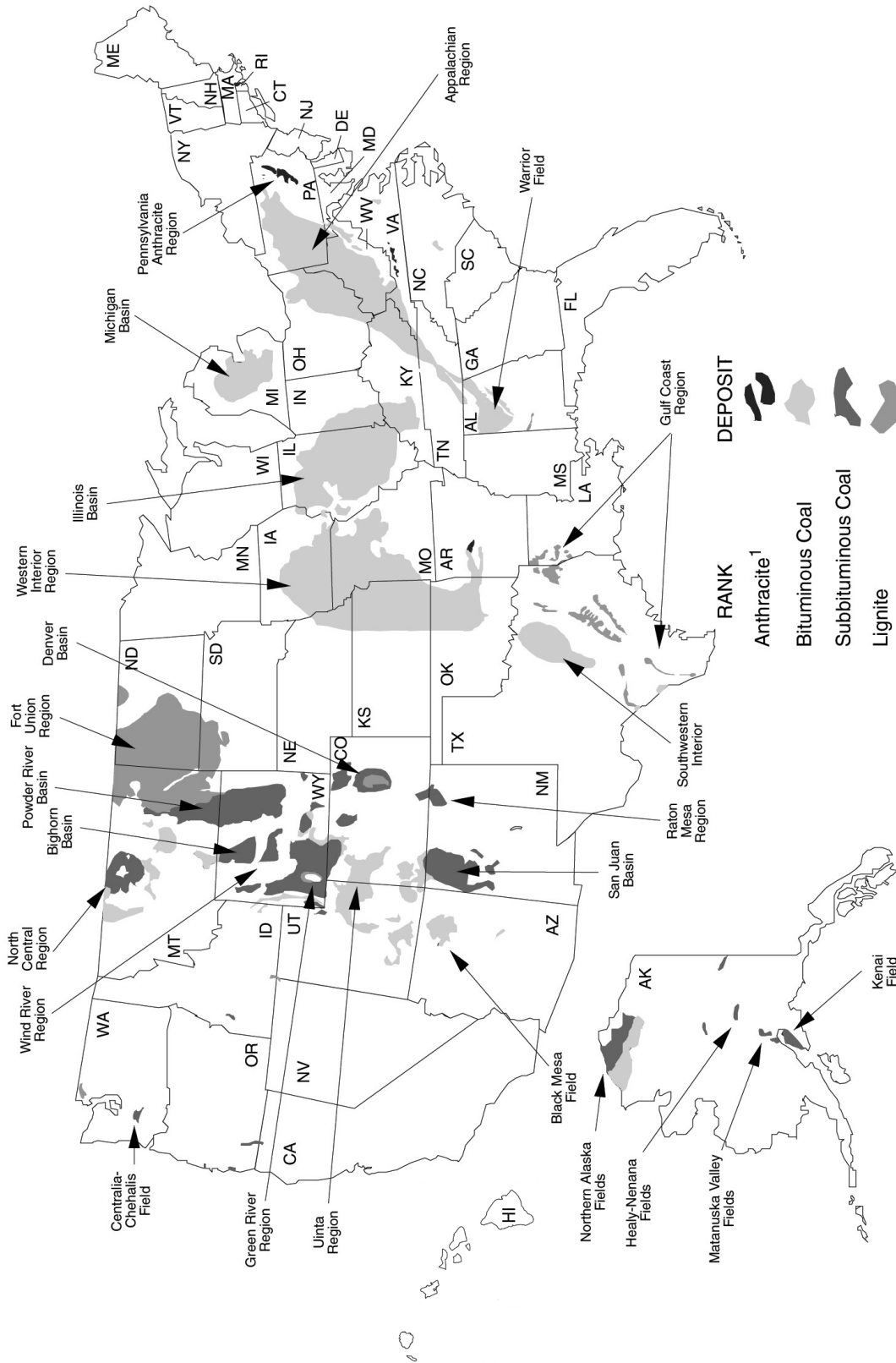
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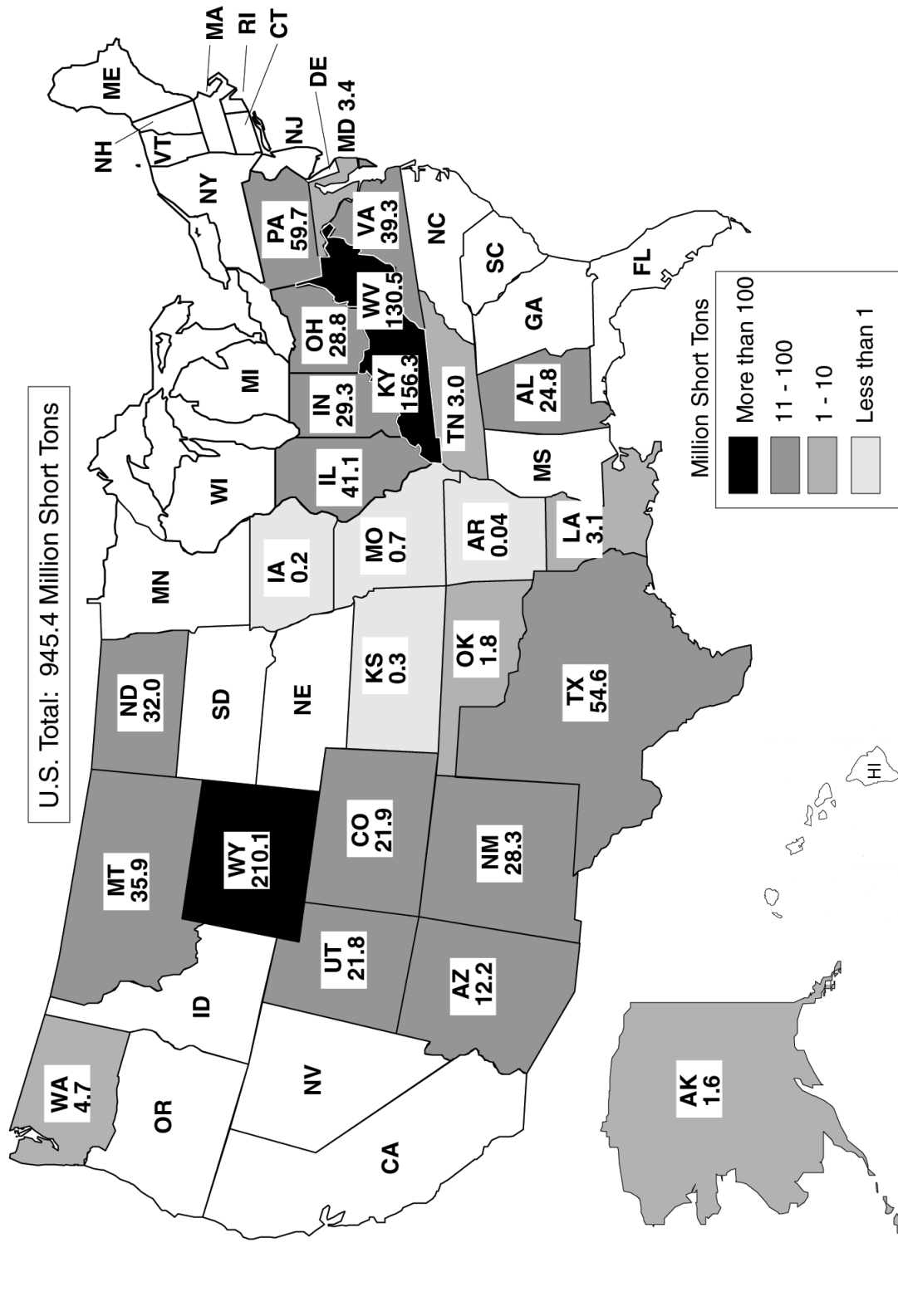
U.S. Coal Deposits



*Principal anthracite deposits are in Pennsylvania. Small deposits occur in Alaska, Arkansas, Colorado, Massachusetts-Rhode Island, New Mexico, Utah, Virginia, Washington, and West Virginia. NOTE: Alaska and Hawaii not to scale of conterminous United States. Small fields and isolated occurrences are not shown.

Source: U.S. Department of Energy, Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels. "U.S. Coal Deposits." p. 7 in *Coal Data: A Reference*. Washington, D.C., February 1995. DOE/EIA-0064 (93).

U.S. Coal Production by State



Source: Energy Information Administration, Annual Coal Report 2013, U.S. Department of Energy, Washington, DC, April 2015.