

Your future is bright in the coal industry



Coal, Careers and You

FIND YOUR CAREER...

IN THE COAL INDUSTRY

Have you ever thought about coal? Some of you might have read an article about coal mining, but you probably haven't given much thought to the importance of coal as a fossil fuel. And perhaps you're unaware of the complex and dynamic industry that surrounds coal's production, transportation and use.

Here's a guide to assist you in learning more about the operation and opportunities in the coal industry. **Coal, Careers and You** highlights the highly skilled, quality jobs associated with the coal industry – from coal exploration through mining and land reclamation to electricity generation, trade and steel production.

For instance, what does robotics have to do with the coal industry? Many underground mining machines are operated by remote control. How does spending time outdoors strike you? Field work is a must for geologists who explore for coal deposits and biologists who help reclaim the land after mining is completed. Perhaps you're computer savvy. These skills are attractive throughout the industry, from working with the satellite-linked Global Positioning System to finding a company's bottom line in the accounting department to calculating coal quality in a coke plant.

Let **Coal, Careers and You** introduce and guide you through the many challenging and rewarding opportunities that await you in today's modern coal industry.

- Remote Control Operator
- Machinist
- Truck Driver
- Barge Operator
- Railroad Engineer
- Safety Foreman
- Supervisor
- Computer Programmer
- Accountant
- Master Mechanic
- Reclamation Specialist
- Environmental Scientist

In the **Beginning...**

Mention the word **coal** to your friends and family, and — beside some funny looks — you'll probably get questions similar to the following...

Just what is this rock called coal?

Where does it come from?

How does it affect me and my lifestyle?

Why should I care about a black rock I've never seen?

For starters, coal can be thought of as a “burnable rock” with lots of minerals in it. It burns because coal is made of carbon, which comes from plants. Many millions of years ago, **geologists** and **paleontologists** believe that enormous amounts of plant matter slowly accumulated in swampy areas and began a slow process of decay. Soon, this matter was covered with soil and silt, then slowly buried and compressed. Over time, pressure transformed this “fossil” plant material into the useful “fossil fuel” we call coal!

Coal deposits can be found in every country in the world, including Antarctica. Moreover, the United States is fortunate to have the world's largest supply of this burnable fuel...enough for another 235 years at the present rate of use!

**Coal deposits
are located in
38 states.**

States with the most coal:

- Montana
- Wyoming
- Illinois
- West Virginia
- Kentucky
- Pennsylvania
- Ohio
- Colorado
- Texas
- New Mexico

From Plants **to Coal**

The abundance and use of coal have helped build our country since its founding. Because of coal, it has become the economic powerhouse it is today. Because of coal's historical role in industry and home heating, the locations of our coal deposits are generally well known.

However, in order for coal to be mined economically, many people are involved in jobs that not only determine the shape of a coal deposit, but also what type of coal it is (see Box this page) and what the Earth looks like around the coal deposit. For example, **drill rig operators** actually drill holes through the deposit to obtain a core sample. Technicians such as a coal **petrologist** then analyze the coal core in a laboratory to determine the type of coal, while a **core analyst** will study the core's rock and coal layers, then plot a map of the shape of the coal deposit.

Surveyors and **mapping specialists** work together to determine the outline and extent of the coal deposit. To outline a coal deposit, they might use traditional techniques that involve math and trigonometry in addition to the satellite-based Global Positioning System, which requires computer skills.

Coal Types

LIGNITE – brownish-black, lowest carbon content and heating value

SUBBITUMINOUS -- dull black, higher heating value than lignite

BITUMINOUS -- “Soft” coal, the most common and widely used coal in the US

ANTHRACITE -- “Hard” coal, nearly pure carbon. Highest heating value

Coal Mining: **Surface**

Coal is mined by two methods. Using large pieces of machinery, surface mining involves the removal of soil and rocks above a seam of coal. The exposed coal is then removed by giant shovels known as “draglines” and loaded into haulage trucks or rail cars.

These machines are some of the world’s largest and most complex pieces of machinery and equipment, requiring the best, most highly trained and skilled men and women to operate. By using machines of all types, the coal industry is regarded as an equipment–intensive industry where machinists and mechanics are in high demand.

- Geologist
- Chemist
- Strip shovel operator
- Dragline operator
- Blasters
- Haul truck drivers
- Mechanics
- Electricians
- Mine Foreman
- General Manager
- Accountant

Spotlight on ... MINING ENGINEER

Are you a big thinker? That is, do you take all the parts of a project or a situation, think them through and then come up with a plan to finish the project or resolve the situation?

Then you might be a terrific MINING ENGINEER, someone who knows how all the jobs listed on these pages fit together in a mine operation. A mining engineer must not only be skilled in technical terms, but he or she must also have management skills plus business skills. Completing this picture is a need to keep protection of the environment in mind in many of the technical and management decisions that must be made in operating a mine. Mining engineers must be able to shift from thinking technically to more operational thinking. For example, when a company plans to extend an operating underground mine into an unmined area, mining engineers must not only address the technical aspect of this move - such as dimension of the coal seam, the seam’s length and width -- but they must also think about how to get necessary equipment and skilled labor into the new area.

Mining engineers are highly skilled thinkers whose ideas and decisions affect the daily handling of a multi-million dollar operation. Long gone are the times of pick-and-shovel miners. Modern mining at the turn of this century requires highly skilled creative thinkers capable of managing several processes at one time.

The average coal miner today has 20 years of experience and earns an average of \$1413 a week.

Coal Mining: **Underground**

When coal is deep underground, **mining engineers** develop a precise and complex plan to tunnel beneath the Earth's crust and mine the coal where it lies. *Underground coal mining* is extremely complex, requiring highly advanced engineering and equipment to produce the coal safely and economically.

Underground coal mines are a logical system of tunnels that allow miners to access the coal seam and remove the coal to the surface. A very important job with an interesting title is that of **roof bolter**. This person is responsible for inserting steel bolts into the top or "roof" of mine tunnels to hold the roof rock in place.

Mechanics in underground coal mines are in high demand, as enormous pieces of mining machinery such as a continuous miner or a longwall mining machine must be taken down the mine elevator shaft and assembled piece-by-piece.

What about the air underground? **Ventilation engineers** who specialize in ventilation of underground mines use their math skills to keep mine air circulating, remove harmful emissions and control dust to protect workers health.

What powers all that equipment? Since electric engines power much of the machinery used in underground mines, **electricians** provide knowledge and skill that keep things moving. Speaking of moving, other mine workers are trained in **haulage systems**, where they work at moving the coal out of the mine either by underground shuttle cars or by a complex series of conveyor systems.

- Longwall operators
- roof bolters
- coal drillers
- ground control engineers
- hoist operators
- continuous miner
- operator
- safety specialists

Reclamation...

One of the most important aspects of coal mining comes after the coal has been mined, but is planned long before mining begins.

It is known as “reclamation” and involves restoring the mined land to its pre-mining condition. Think of it this way: if you dug a hole in your back yard, filled it with soil, sowed some grass seed, plants or trees on it and kept it watered, soon the grass and plants would grow back. In time you probably couldn't tell where you dug that hole because you had “reclaimed” it.

Reclamation of coal mines, especially surface coal mines, is somewhat like that, except on a much larger scale.

Office of Surface Mining Reclamation Awards:

“Since 1986, the Office of Surface Mining (OSM) -- the federal agency that regulates surface coal mining -- recognized outstanding examples of coal mine reclamation through the OSM Excellence in Surface Mining Reclamation Awards. Awards have gone to mining companies operating in Alabama, Arizona, Illinois, Indiana, Kentucky, Maryland, Montana, New Mexico, North Dakota, Ohio, Pennsylvania, Texas, Washington, West Virginia and Wyoming. In reclaiming their properties, employees at these companies have...

- worked with Native Americans to plant vegetation special to tribes
- cleaned up old piles of anthracite coal washed from an underground mine, using the coal to generate electricity
- returned two and half miles of degraded stream to its natural state by integrating it with surrounding wildlife habitat
- used plants native to the area to turn a former lignite mine into wildlife habitat.

Helping Restore **the Environment**

People who work in the reclamation part of mining have job titles such as **environmental coordinator, environmental technician, environmental manager, permit manager and reclamation botanist**. These specialists have backgrounds in geology, chemistry, soil science, biology, botany or other earth sciences. Because coal mining impacts nature and the Earth, these specialists use their skill and knowledge to diminish coal mining's imprint on the landscape, while allowing the production of a product vital to the nation's economy.

- Environmental Coordinator
- Environmental Technician
- Environmental Manager
- Permit Manager
- Reclamation Botanist

Reclamation Success Story:

Since coal production began in 1978, employees of the Jacobs Ranch Mine near Gillette, Wyoming, have successfully reclaimed over 2,700 acres of semi-arid mined land, returning it to cattle grazing and wildlife habitat. Today, large herds of antelope, deer and elk roam the reclaimed former surface mine. Because of the successful integration of mining and reclamation, the productivity of the reclaimed land is almost twice as great as adjacent "natural" lands, leading to a greater ability of the land to sustain life – its "carrying capacity."

Safety and **Health...**

Perhaps the most important jobs in the coal mining industry are those associated with protecting the health and safety of coal miners and other employees at the mines. These **safety specialists** help contribute to a ten-year decline in the number of serious injuries and fatalities at coal mines.

There's an area of specialization in the workplace known as "**industrial hygiene**" and these programs in the coal industry are among the finest in American industry. Coal industrial hygiene and safety programs focus on protecting miners from coal mine dust, methane gas, noise and contact with toxic materials.

Spotlight on... Sentinels of Safety

Each year, the mining industry and federal government join together to honor and recognize the safest mines in the country. Through the prestigious "Sentinels of Safety" competition, mining companies with the best safety records are recognized for the teamwork and safety consciousness of their employees. To qualify for the award, a mining operation must compile at least 30,000 employee hours without a lost-time injury or fatality. By observing and enforcing all mine safety requirements, Sentinels of Safety winners show that company and employee commitment to safety in the workplace requires skill, teamwork and safety priorities.

Recent Sentinels winners have worked an average of 300,000 employee hours without a lost time injury. Now that's teamwork!

Protecting Coal Mining's **Employees**

Although coal mining is an inherently hazardous job, many efforts are made to protect the health and life of miners, particularly respiratory health and hearing.

Due to these efforts, the coal mining industry has an injury rate lower than many other industries, including construction and manufacturing.

Do you think that your interest in first aid could lead you to become an **Emergency Medical Technician**, or EMT? Mines need first aid specialists along with EMTs, to help fellow employees with any on-the-job injuries.

Do chemistry and biology interest you? A background in these courses could lead to a career in industrial hygiene as a **dust sampler** or **ventilation engineer**, where you would be working to protect the respiratory health of miners.

- Mine rescue specialists
- Rock mechanics engineers
- Industrial hygienists
- Directors of Safety Training
- Ventilation technicians or engineers
- Safety inspectors
- EMTs (emergency medical technician)

Coal Equals... **Energy!**

So far in this booklet, the focus has been on all the jobs that help get the coal out of the ground. But for what? Why all this effort and planning to dig up black rocks?

Let's answer this question by asking other questions: Do you use electricity? What kind of electronic gadgets do you use everyday? A radio alarm clock? A refrigerator? A computer or T.V.? All these appliances in your homes, schools, hospitals, stores and factories...ALL are powered by electricity. And the burning of the "fossil fuel" coal generates about half of all electricity used in the U.S. (45% in fact).

Where is this coal burned to get electricity? At a "power" plant or a utility. What happens is that when coal is burned, it gives off heat, which heats water to boiling so it gives off steam. In turn, this steam turns the blades of a turbine, which is hooked to a generator that creates electricity. The electricity is then sent out across transmission lines and substations to your home and school.

All along the way in this transformation of coal to electricity, thousands of people work in various jobs in the 600 coal-based power plants located in 47 states. A **power plant supervisor** must make sure that employees keep a constant supply of coal in the boilers to heat the water, which a conveyor technician does when he or she runs coal from the coal yard into the plant.

Environmental engineers must assure that the air and water around the plant are protected through the use of highly complex technological systems that scrub harmful agents from gases released from burned coal and monitors water used in the plant before its release. Utility linemen are the people you see climbing around the enormous transmission towers or checking out a substation.

Many of these and other power industry jobs need bright people who can work as a team to solve problems by thinking many things through.

- Power Plant Supervisor
- Conveyor Technician
- Environmental Engineer
- Utility Lineman

Transporting **Coal...**

Transportation of coal is the vital link between mined coal and its use in a power plant or steel mill. Coal is moved either on the railroads, on rivers by barge or in large trucks.

When it comes to shipping coal, railroads lead the way, moving 700 million tons a year on 108,000 miles of freight railroads! Barges move 110 million tons of coal annually on 11,000 miles of navigable rivers and waterways, while trucks carry 100 million tons on the Nation's 3 million miles of highways and roads.

In many instances, all three modes of transporting coal are used to ship the same coal from mine to power or coke plant; this is known as intermodal transportation.

A career in the transportation sector of the coal industry could be attractive to you, particularly if you enjoy seeing different parts of the country, enjoy working with large moving vehicles and like working outdoors in all kinds of weather.

By Water, By Rail, By Truck

Does working on a freight train, travelling from town to town through the countryside, interest you? Job titles such as **conductors, locomotive engineers, brake, signal and switch operators** and **rail yard engineers** are common throughout the railroad sector. According to the Bureau of Labor Statistics, competition for railroad jobs is keen because the pay is good and the work steady.

- Conductors
- locomotive engineers
- brake, signal and switch operators
- rail yard engineers

Railroad workers must have a high school diploma or GED (General Equivalency Diploma). They must also have good eyesight, hearing, and color vision. Good hand-eye coordination, manual dexterity and mechanical aptitude are also required. Because of the importance and seriousness of working with large mobile machinery, applicants must pass a physical exam and tests for drug and alcohol use.

Riding the Unit Train

Most coal in this country moves from the coal mine to a power plant on a special train called a “unit train.” Up to 150 cars long, these trains can carry between 12,000 and 15,000 tons of coal to a power plant. The unit train engineer and the unit train conductor work as team, with the conductor handling most of the paperwork and calling out track signals to the engineer as they move along. Because the newer unit trains now have on-board microcomputers that are in contact with other railroad computers, computer skills are a must for both engineer and conductor. To work on a unit train, extensive training is required, as is a federal license. Many junior and community colleges are now offering railroad courses.

Coal and **Trade...**

Although much of the nation's coal is transported to power plants for the generation of electricity, close to 82 million tons are readied for export to more than 40 nations. These trading partners receive U.S. coal for use in electricity generation ("steam coal") or for making steel ("metallurgical coal.") Metallurgical coal accounts for about 69% of total exports.

Most of our exported coal goes to our neighbor to the north, Canada, followed by Brazil and the Netherlands. Other countries receiving U.S. coal are China, South Korea, the United Kingdom, Italy and Japan.

It's International

Around the United States, seven major export terminals receive coal transported by rail or barge to the center. More than half of all coal exports leave the export terminal at Hampton Roads, Virginia, on large bulk carriers or ships. Other important coal ports include Baltimore, Maryland; New Orleans, Louisiana; Mobile, Alabama; and Los Angeles/Long Beach, California.

Along with the transportation jobs mentioned earlier, shipping and trade of coal include varied jobs, from **dock workers and crane operators to terminal superintendents and ship captains.**

Companies that ship coal overseas need employees familiar with international markets. For instance, an **international market manager** for coal would be responsible for all sales, pricing and marketing activities for selling that coal overseas. He or she would rely on an **international pricing analyst** for data research on pricing and contracts, and also on a **senior international analyst** for identification and evaluation of the company's international customers. Persons in these careers must be able to speak the language of the countries in which they work.

- Dock workers
- crane operators
- Terminal Superintendents
- ship captain
- International pricing analyst
- Senior environmental analyst

Steel + **Coal...**

Bet you didn't know that coal is an important ingredient in making steel – steel that's used in everything from skyscrapers to bulldozers to guardrails to knives and forks.

In 2010, 20 million tons of coal were used by the iron and steel industry. Before it can be used to make steel, the coal must first be transformed into coke (NOT the drink!) Coke is a substance that forms when coal is heated to very high temperatures, but not burned. Coke is then mixed with pelletized iron ore and limestone in a blast furnace and that begins the steel making process.

Another type of coke is called “foundry” coke and it is used for making iron products such as manhole covers and iron water mains. Auto manufacturers also require coke, for by mixing it with scrap iron and limestone, they manufacture engine blocks for cars and trucks.

For Bridges, Buildings, **Schools & Tools**

Currently, 19 coke plants operate in 9 states and produce about 15 million tons of coke annually.

States where coke is produced:

Alabama	Ohio
Illinois	Pennsylvania
Indiana	Virginia
Michigan	West Virginia
New York	

Since the coke industry is an “equipment intensive” industry, it is in constant need of **good machinists** and **master mechanics**. Basic labor jobs include **forklift operator**, **train engineers**, **front end loader operators** and other basic construction-type jobs.

The **quality control manager** assures that incoming coals meet specifications for coke quality; he or she depends upon a **petographer**, working in a lab, to determine which coal form will result in the best coke.

One of the highest paying jobs in the coke industry for skilled labor are “**refractory brick masons**.” They are responsible for the highly specified laying of refractory bricks that line the ovens where coal is cooked into coke.

- Forklift Operator
- Train Engineers
- Front-end Loader Operators
- Refractory Brick Masons
- Master Mechanics
- Quality Control Manager
- Petographer

HOW TO...

Would you like to learn more about careers in the coal industry? Or perhaps you'd like to visit a power plant or a railroad yard? The suggestions and groups in the following list should point you in the right direction to learn more about opportunities in the coal industry.

1. Start by contacting your state or local Chamber of Commerce for the names and numbers of any power plants, coal mines, rail yards, barge facilities or steel mills in your area.
2. Next, contact the business you're interested in and ask to speak with their "Public Affairs" or "Public Relations" office. These offices can also be known as community relations, public outreach or communications department.
3. Tell them who you are, where you teach or attend school, and ask if class tours are available. If a tour is not possible, ask if an employee can come talk to your class about their jobs and how the job fits into the big picture of our economy.

Learn More About the **Coal Industry**

For more information, please contact any of the following government agencies, associations, professional societies:

American Coal Foundation
101 Constitution Avenue NW
Suite 500-E
Washington, DC 20001
202/463-9785
FAX: 202/463-9786
www.teachcoal.org

American Geological Institute
4220 King Street
Alexandria, VA 22302
703/379-2480
FAX: 703/379-7563
www.agiweb.org
www.earthsciweek.org

Bureau of Labor Statistics
Occupational Outlook
Handbook
www.stats.bls.gov

U. S. Geological Survey
Coal Resource Assessment
956 National Center
Reston, Virginia 20192
www.usgs.gov

National Mining Association
101 Constitution Avenue NW
Suite 500-E
Washington, DC 20001
202/463-2625
www.nma.org

United Mine Workers of
America
18354 Quantico Gateway
Drive
Suite 200
Triangle, VA 22172
202/842-7200
www.umwa.org

Bituminous Coal Operators
Association
801 Pennsylvania Avenue NW
Washington, DC 20004
202/783-3195

American Iron and Steel
Institute
202/452-7100
www.steel.org

American Coke and Coal
Chemicals Institute
1140 Connecticut Avenue,
NW
Suite 705
Washington, DC 20036
202/452-7198
www.accci.org

Association of American
Railroads
425 Third Street, SW
Washington, DC 20024
202/639-2100
www.aar.org

Helpful Skills and Courses for **A Career in the Coal Industry**

Many companies and agencies associated with the coal industry seek employees who exhibit some of the skills listed below. Participation in high school courses such as math, science, physics and team-oriented activities such as sports and band are also attractive.

SKILLS:

- creative thinking
- good reading comprehension
- problem solving
- technically oriented
- able to use a computer or computerized electronics
- Bilingual
- mechanical skill – like to tinker with and fix machines
- Like to read equipment manuals
- negotiating skills
- electrical skills
- ability to plan and design
- knowledgeable about reading maps

COURSES AND ACTIVITIES:

- engineering
- earth science
- computer science
- mechanics or shop classes
- second language
- physics
- chemistry
- writing and composition
- biology
- math
- calculus