



# Fossil Fuels From the Forest

Where Does Coal Come From?

Activity Guide

**Description:** This two-part activity introduces visitors to the life cycle of coal, from carbon in plants to carbon in the atmosphere. Visitors will then complete a hands-on activity where they “mine” chips from a cookie to explore the implications of coal mining.

**Audience:** Hands-on activity for families and kids ages 5 and up

**Length:** 25 minutes

## Learning Objective

Visitors will learn that coal deposits are ancient plant remains that formed from thousands of years of heat and pressure. There are many negative implications of using coal as an energy source, both from extraction and release of carbon emissions.

## Climate Connection

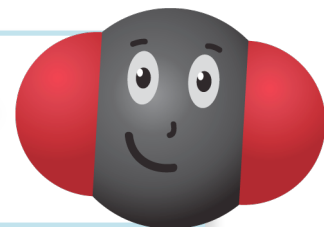
In the United States coal is our main source of energy for electricity. Coal is made from ancient plants that undergone extreme heat and pressure for thousands of years, a process similar to what makes a fossil. That’s why coal is known as a fossil fuel. Coal is a non-renewable resource, once we use up our current reserves it cannot be replaced (or “renewed”). This means that once all the coal is gone, we won’t be able to replace it.

Because it is made of ancient plants, coal has large amounts of carbon atoms. When we burn coal, we convert some of the energy stored in the carbon atoms into electricity. This electricity is used to power our homes and cities. Burning coal releases carbon atoms that combine with oxygen to produce carbon dioxide (CO<sub>2</sub>) in our atmosphere. Carbon dioxide traps heat and contributes to the greenhouse effect that causes climate change.

The implications of mining for coal are another consideration when using coal for energy. In order to access coal deposits, or all of the stored carbon in ancient plant matter, we need to mine the surface of the earth. There are negative implications of coal mining, both on ecosystems and on human health.

### ***Did you know?***

*Oil is another fossil fuel that is nonrenewable because it is made of ancient animal matter. It takes hundreds of thousands of years for oil to form.*



## Materials

- Life cycle of coal cards
- Anthracite coal samples
- Toothpicks
- Chocolate chip cookies
- Napkins

## Set up

- Prepare and review the Life Cycle of Coal cards and decide on a presentation method. The cards can be presented as a whole or used to challenge the participants to put them in order on their own.
- Organize the workspace so visitors will have table space to “mine” their cookie. Sort cookies, toothpicks and napkins for each participant.

## Program Delivery

### **PART ONE: LIFE CYCLE OF COAL (if using presentation method)**

*Do you know what this is?* [Show visitors a piece of Anthracite coal]

Anthracite coal has low moisture, high carbon content and was the first of the coal types to form and thus it is the oldest. It is mined primarily in northeastern Pennsylvania.

*What do we use coal for?*

Over half of the heat and electricity in the U.S. was produced from coal<sup>1</sup>. Coal is an important fossil fuel that we use for heat and electricity. For the past hundred years we have been taking coal out of the ground and burning it for heat and electricity. It has been a very important fossil fuel that has helped us keep the lights on, and stay warm in the winter and cool in the summer.

*What is coal made of?*

Around 300 million years ago much of the earth was covered in plants like these. [Show Card 1: Ancient Plants]

These plants used carbon dioxide (CO<sub>2</sub>) from the atmosphere to build massive forests. An incredible amount of carbon is stored in these plants. This carbon is very important, as it is the basis of the coal that will form. Over time, the vegetation in the forest dies and forms peat or partially decomposed organic matter. [Show Card 2: Ancient Forests Form Peat]

The next stage involves lots of time, heat, and pressure. The peat is buried in and compressed under sediment. [Show Card 3: Coalification Process]

Time, heat, and pressure remove water and form hydrocarbons. After this stage the developing coal is made almost entirely of carbon! These carbon deposits then form coal deposits deep under the surface of the earth. [Show Card 4: Coal Forms!]

The type of coal is determined by how much carbon is in the coal deposit. The anthracite coal that we commonly use to heat our homes has a very high carbon content and is the first type of coal to form and thus the oldest and hardest coal.

Although it took thousands of years for coal deposits to form under the surface of the earth, the next few pictures in the life cycle of coal happen relatively quickly, usually in less than 20 years.

*The mining process!*

Heavy machinery is used to extract coal and other minerals from the Earth. This process is called mining and it has negative effects for the environment. [Show Card 5: Mining Coal]

The coal is then transported to a manufacturing plant. [Show Card 6: Transporting Coal]

At the manufacturing plant coal is burned, and the heat energy produced is converted to electricity. [Show Card 7: Power Plant]

*What happens to coal when it is burned?*

In the burning process, the carbon in coal combines with oxygen in the air to create carbon dioxide. [Show Card 8: Carbon Dioxide (CO<sub>2</sub>) Molecule]

Carbon dioxide is an important greenhouse gas that helps to keep our planet insulated and warm. Recently, scientists have discovered that too much carbon dioxide (CO<sub>2</sub>) in the atmosphere can lead to climate change with harmful effects.

The large amount of carbon dioxide (CO<sub>2</sub>) pollution from burning coal is only one of the problems with relying on coal as an energy source. There are also negative side effects that occur when we mine coal from the earth's surface.

**PART TWO: COOKIE COAL MINING (if using presentation method)**

*What are some things that coal miners use to reach the coal deposits?*

Remember that coal deposits are ancient plant remains that are located beneath the Earth's surface. Coal miners have to dig into the Earth's surface to reach the coal deposits. Tools are an important part of coal mining. Your tool as a coal miner will be this toothpick.

*How many coal pieces do you think you can extract?*

The surface of the earth that you will "mine" is represented by this chocolate chip cookie. Estimate how many coal pieces we will be able to extract from our cookie using the toothpick.

*Do you think you will be able to put your cookie back together?*

The cookie must be flat on the table. Just like it is not possible to pick up a hillside, you cannot pick up your coal seam. Observe what happens to the cookies when you start drilling.

**Discussion Questions:**

What sort of difficulties did you have in mining your cookie? Your process of mining the cookie is similar to strip mining, the most common method used in the U.S.

Can you put your cookie back together? Do you think there are similar problems after strip mining the earth's surface?

How could we put the cookie back together?

How many coal deposits did you collect? Was this more or less than you expected?

What are some ways that we could improve mining practices?

Aside from mining what are some of the other negative things about using coal for energy?

Besides coal, what are some other sources of energy?

**Resources**

<sup>1</sup> Department of Energy: <http://www.energy.gov/energysources/coal.htm>

**Credits**

This project is made possible by a grant from the U.S. Institute of Museum and Library Services  
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