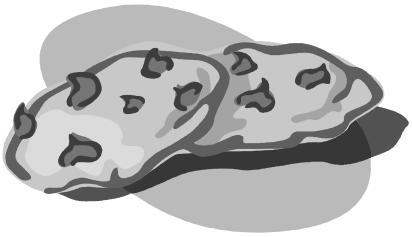
# Mining for Fossil Fuels

Grade: K-6

Subject/Topics: Energy, Coal, fossil Fuels, Mining, Nonrenewable resources, Ozone layer, Greenhouse effect, Land reclamation



Time: 30-45 minutes

Learning Objectives: Students will:
1. Gain an understanding of the difficulty associated with extracting a limited resource such as coal from the Earth without destruction of the surrounding land, and
2. Discover that nonrenewable resources cannot be replaced.

Materials: One hard chocolate chip cookie per student, one soft chocolate chip per student, and one round toothpick per student.

**Background**

1.Of the world's commercial energy, 88% is supplied by the three nonrenewable fossil fuel resources: coal—28%, oil—39% and natural gas—21%.

2. Coal began forming 300 million years ago as a spongy mass of organic plant material in wet, swampy areas. This is called PEAT. From the peat a low-grade type of coal called LIGNITE was formed. With time, heat and heavier sediment, the lignite turned into BITUMINOUS (soft) coal. Eventually, over millions of years, the material became harder and changed to ANTHRACITE. Bituminous and anthracite are better sources of energy.

3. Bituminous coal is the easiest to mine and the most widely used, supplying 20% of the world's energy needs. It can be mined by surface ( or strip mining). Surface mining results in the best use of coal, and accounts for over 60% of the coal production today, besides being a very efficient method of mining.

4. If the coal is deep, however, UNDERGROUND MINING occurs. In flat areas, the coal is reached by a vertical shaft. In the hills, the coal is mined by a drift- mine opening.

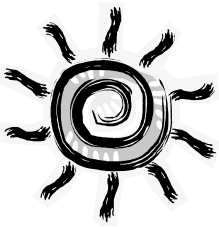
5. Surface mining destroys the landscape, but areas can be reclaimed after mining has ceased. The cost of reclaiming land is often borne by the consumer in the form of higher coal prices. Underground mining does not disrupt the surface but often produces large waste piles. The anthracite coal located there is the most desirable grade of coal because it provides more energy and burns cleaner than the other coals, but it is not as common, and is difficult to obtain because it is so deep, making it more expensive.

6. Discuss the students use of energy at home. Your day begins when a tune wakes you on the radio. You jump out of bed, flip on the hot water and take a shower. Your day continues in the kitchen where breakfast is prepared. You pop bread into the toaster, heat up some oatmeal in the microwave, and pour a glass of OJ from the refrigerator. Before leaving your home, you quickly run the iron over a wrinkle in your shirt, blow dry your hair and you're ready for a busy day. The day began with little need to ponder the electric energy used to make your life easier and more comfortable. Where did the energy come from? How was the energy produced?

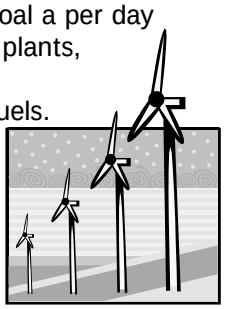
7. Scientists have discovered two rules that govern where we can get energy and how we use it. The first tells us that the amount of energy in the universe is constant. It never changes. Energy changes from one form to another over and over again, but the total remains the same. Electric energy can be turned into heat energy, heat energy can be changed into light energy, which can be changed into light energy, which makes plants grow, and those plants give us energy when we eat them, which we use to do work. Every moment of the day as we work and play, think or read, we are converting energy from one form to another. In doing so, we may use up a particular form of energy, but the total amount of energy in all stays the same.

8. The second rule is that we can't use some kinds of energy. Every time energy is changed from one form to another, some of that energy is converted to waste heat, which spreads out into the atmosphere and eventually out into the atmosphere and eventually radiates out into space, where it can never be used again.

9. Concentrated (more valuable) forms of energy, like coal or oil or natural gas (FOSSIL FUELS, can't be used without changing them into dilute (less valuable) forms of energy like hot air. Every time we use up a little of our available ENERGY RESOURCES, there is less to go around.



10. Energy is all around us. The sun is the single greatest source of energy for the planet Earth. It gives us heat and light energy that helps our crops to grow and can be harnessed for the production of electricity. The radiant energy supplied by the sun on a clear day to one square meter of ground can power a hundred watt light bulb. Most homes are powered by the chemical energy of burning coal, which turns an electric generator in your neighborhood power plant- a pound of coal a per day will light the 100 watt light bulb. Coal, a fossil fuel formed form dead plants, actually holds energy that came from the sun long ago.



11. Humans have found many sources of energy in addition to the sun and fossil fuels. Wind power, water falling over a dam, and tides can give us power. Some atoms provide energy when they are split apart in nuclear reactors, and some day we may harness "fusion energy" by combining atoms in the same way the sun produces its energy. In most cases, our energy resources are running out at an alarming rate. Diminishing supplies, and the difficulty of finding new sources, have forced us how to consider how to conserve what we have.

12. This energy frontier will require everyone's help. It is one we all can play a part just by conserving. Even though you may not be ready to discover an alternative fuel, design new low-energy use light fixtures, or construct new types of solar generators, you do have the opportunity to do something truly remarkable just by understanding the problem and taking action. Until more of our electric needs are net in other ways, our need for electricity will have to be met by the use of limited supplies of coal and oil. These energy resources are NONRENEWABLE. They cannot be produced or replaced once they are gone.

13. In addition, the burning of fossil fuels is increasing the amount of carbon dioxide in the atmosphere. The earth may be growing warmer and this is known as the greenhouse effect. Burning fossil fuels also creates air pollution, acid rain, and makes holes in the ozone layer.

14. Everyone needs to find ways of using less electricity. Companies need to develop products that use less electricity and scientist s need to continue their search for new and better ways of using natural sources of energy.

**Procedures**

1. As an introduction to this activity discuss briefly with students the process of extracting coal from the Earth and burning it to produce electric energy. Prepare them for the activity by relating the chocolate chip cookies to different land types (solid and rock), each type with a limited supply of resources (chocolate chips). Although removal of the resource is the priority, have students identify a few other considerations when mining a resource, such as land destruction, how long it takes, etc. These other considerations, when put into practice by the students in their simulated extraction, will enrich the discussions afterwards about efficiency, speed, LAND RECLAMATION, and other concerns. Land reclamation means to return the land surface to its original state or as near as possible. Surface is graded, topsoil is returned, and trees are planted.

2. Provide each student with their two cookies and the EXTRACTION DEVICE (toothpick). Have the students first observe their cookies and estimate the number of chocolate chips they expect to be able to extract with the toothpick from each type of cookie. Record these extraction estimates, for the STRIP mining and for deep or underground mining.

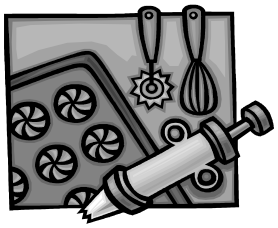
3. Using only the toothpick as an EXCAVATION/EXTRACTION tool, have the students extract or remove as many of the chocolate chips as possible within 15

minutes. Again, remind students that the less damage they do to the land mass (the cookie material), the less it will "cost " them later.

4. At the end of the fifteen minutes, have students count the number of chocolate chips they extracted from each cookie. Discuss the reasons for any discrepancies between the two numbers. (Harder than it looks. land types can present problems for miners, etc.)

5. Advise the class that each chocolate chip represents a day's worth of electricity for their community. In addition, it will cost a certain amount of chocolate chips to "repair" the land mass they have just mined. In order to get the latter point across, have the students set aside some of their "extraction resources" for the land reclamation. Use the following scale:

| Condition of Cookie | #of chips set aside |
|---|---|
| Still whole, only pitted | 1 chip |
| In 2-4 pieces | 2 chips |
| In more than 5 pieces | 3 chips |
| Cookie in crumbs | 4 chips |



6. After accommodations for land reclamation, have each student add up their remaining extracted resources and calculate a total for the whole class. (After all calculations have been completed, allow the students to taste the fruits of their labors.) Assign a value and convert this total to "days of electricity" for the community and discuss what this may mean to the student's lifestyle. Discuss the following questions as a group; answers will vary.

a) How long will the "energy" resources of the class last?
b) As the supply of resources is depleted, what will happen?
c) How can the classes' resources be made to last longer?
d) Which land- type (cookie) was the easiest to extract from?
e) Which extraction techniques were the most efficient?
f) How are the Earth's land surfaces reclaimed after mining?

**Evaluation**

What conclusions do you draw from this tasty exercise? Answers will vary: easier to extract from soil than rock, fossil fuels are scarce, hard to mine, destroy the land, we should reuse and recycle products made with or by (energy source) fossil fuels to conserve our limited supply and save the land.

**Extensions**

1. Visit a local power generator and/or mining operation to observe the extraction techniques, uses of resources, waste and land reclamation processes.
2. Research other resources mined and extracted from the Earth. Report to the class on the complete story to be told from raw natural resource to finish product.
3. Design and construct a poster depicting the story of an energy resource from its source (mining, logging, river dam, etc.) to its use in a home as electricity. Compare your story with other students' renditions of the same story of a different resource.

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