Fossil Fuels

Strand	Earth Resources	
Topic	Nonrenewable resources	
Primary SOL	3.11	The student will investigate and understand different sources of energy. Key concepts include c) sources of nonrenewable energy.
Related SOL	3.1	The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which c) objects with similar characteristics or properties are classified into at least two sets and two subsets; h) data are gathered, charted, graphed, and analyzed; j) inferences are made and conclusions are drawn; m) current applications are used to reinforce science concepts.

Background Information

Coal, oil, and natural gas are called *fossil* fuels because they come from plants and animals that have been buried for millions of years. These energy sources are considered nonrenewable because once they are consumed; they are gone for our lifetimes: it will take millions of years to produce more under special conditions.

Coal is primarily used to generate electricity. It is used to heat water, which turns into steam. The steam is used to turn the blades of a turbine. Coal is made as organic matter accumulates and forms a bed of peat. Other sediments bury the peat bed. Heat and pressure from being beneath other sediments become compressed and chemically changes into low-grade coal. Under further heat and pressure, the low-grade coal is converted to a higher-grade coal.

Natural gas is used to generate electricity by heating water; much the same way as coal. Natural gas is created when dead plant matter drifted to the ocean bottom along with twigs and trees forming organic-rich mud. Over millions of years, and under pressure and heat, the mud became shale and the plant matter decomposed to natural gas. Over more time, the gas slowly migrated to sediments such as sandstone and limestone where it was trapped and later drilled.

Petroleum is made from the remains of plants and animals that collect on the ground, but instead of undergoing decomposition by microbes, the organic matter sinks into an environment where it is protected from decomposition (such as the bottom of deep stagnant swamps or lakes or restricted basins with poor circulation on continental shelves in the oceans). The organic matter is trapped over time by the layering of sediment over the top of the deposit. With high pressure and temperature, it is transformed into oil.

Materials

- Thick raisin cookies
- 1 paperclip per student
- Napkins
- Pencil and paper

- "Coal Deposits in Virginia" map
- 300 large, colored paperclips
- Copies of How Many Paperclips? sheet

Vocabulary

energy, nonrenewable energy-source, coal, oil, natural gas

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Introduction

1. Prior to the lesson, hide 300 large, colored paperclips around the classroom.
2. Demonstrate energy to the students using a pinwheel and a piece of coal or charcoal.
3. Facilitate a discussion about energy and its sources.
4. Ask the students which type of energy – the pinwheel or the coal – do they think would last longer. Have them explain their reasoning. Describe to students how fossil fuels are formed and where they are found, and introduce the idea that they are nonrenewable resources. Emphasize how they are used as sources of energy. Lead students into the activity by telling them that they will be discovering how fossil fuels are retrieved from under the ground.

Procedure

Part 1

1. Give each student a thick raisin cookie, paperclip, and napkin. Tell them that the cookie represents the state of Virginia. The tan area represents the Earth's crust, and the raisins represent coal deposits. They are going to "mine" the cookie.
2. Instruct students to count the number of visible chunks of coal in "Virginia," counting only the coal deposits visible from the top. Have them record this number.
3. Have students make a prediction and record how many coal deposits (raisins) will actually exist in "Virginia" if they look for them below the surface. Have them record this number, and record the class information on the board as well.
4. Have students use their paper clip to begin mining their coal deposits. Place the coal deposits in one pile and the Earth's crust in another pile. Have students count the coal deposits and record the data.
5. Have the students compare and contrast the number of coal deposits visible on the surface with the number of those actually in existence. Ask them to compare the actual number of coal deposits with their predictions.

Part 2

1. This part of the lesson can be done intermittently throughout Part 1.
2. Arrange the students into pairs or groups of three.
3. Direct the students to search for paperclips (natural gas or oil) in 30-second opportunities.
4. At the end of each allotted time period, students should count their paperclips and record the number in a bar graph.

Conclusion

1. Point out that there were more "coal deposits" than could be seen on the surface.

2. Discuss the fact that mining the coal disturbs the Earth's crust. This means mining coal has a destructive environmental impact. To illustrate this point, have students describe the mess of crumbs on their napkin as if it were a huge heap of rocks and soil. Ask them whether they think this "land" could be made to be "natural" and attractive again so that it would grow trees and other plants. If so, how?
3. Stress that the "coal deposits" were unevenly distributed, which meant that some students had more coal deposits than others had. Display a map of Virginia that shows where real coal deposits can be found.
4. Lead a discussion about why the number of paperclips went down each time. Students should be able to reason that there was a limited supply after each search.

Assessment

- **Questions**
  - Why are coal, natural gas, and oil considered nonrewable?
- **Journal/writing prompts**
  - Have students describe why it takes energy to get energy from fossil fuels.
- **Other**
  - Assess answers to questions in the conclusion section of the lesson.

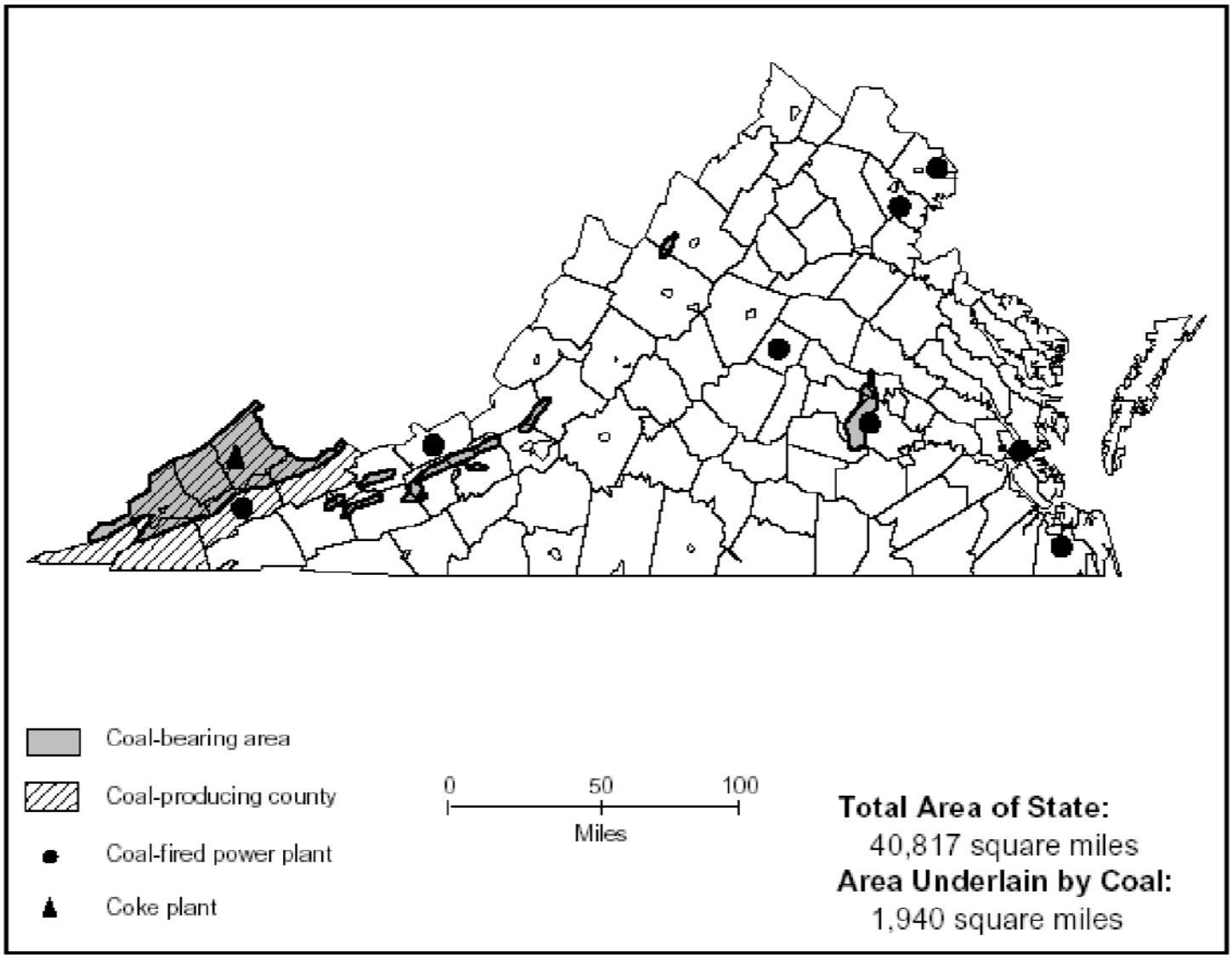
Extensions and Connections (for all students)

- Have the students research oil and natural gas and present a class discussion on how they are obtained from beneath the Earth's surface.

Strategies for Differentiation

- Show a computer video about mining coal to establish background knowledge.
- Change the number of paperclips from 300 to 100 and tape the paperclips onto an enlarged hundreds grid for a visual as to the depletion of resources.
- As discussion questions are posed, ask partners to discuss answers, allowing them a couple minutes to share ideas. Ask for pairs to share each others' ideas. Optional: put pairs in quartets and repeat.
- Provide a word bank for use in journal writing activity.
- Have students in small research groups and create a PowerPoint slide show on an assigned fossil fuel. Presentations will be made to the class.
- Take a virtual field trip to a coal mine.
- Contact the Chamber of Commerce for a state (e.g., West Virginia) to get information about coal and its production.
- Invite a representative from the local gas company to discuss how gas is used to heat homes.
- Have students identify how various forms of fossil fuels are used in their neighborhoods.
- Have students develop a class survey to determine which fossil fuel is used most often by the students in the class, grade level and school. Plot the information on a graph.

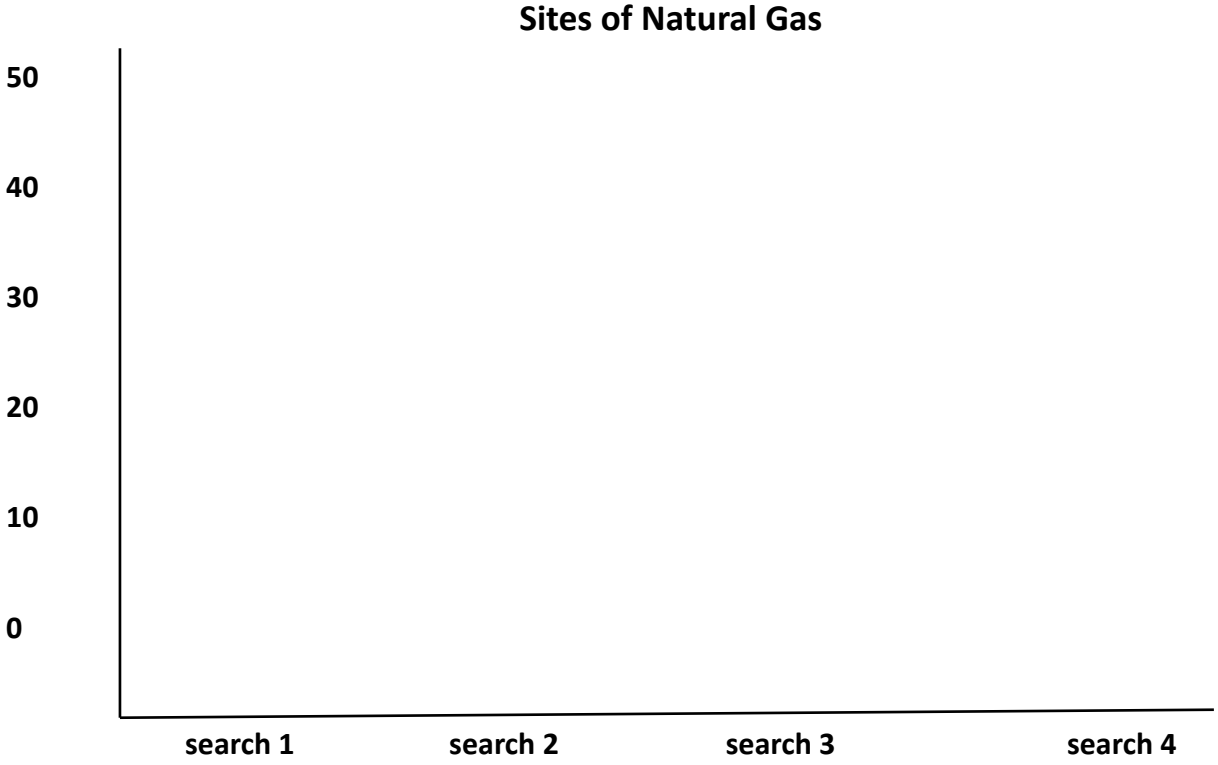
Coal Deposits in Virginia



How Many Paperclips?

What do the paperclips in this activity represent?_____

Complete the graph below with the information from your searches.



Questions/Inferences

1. **In which search did you find the most paperclips? _____**
2. **In which search did you find the least paperclips? _____**
3. **What is the difference between the largest and shortest bars on your graph?_____**
4. **Why do you think it became harder to find paperclips with each search?**

   _____

   _____

5. **If you were really searching for natural gas sites, what does the graph tell you about finding natural gas? _____**

   _____

6. **Why are natural gas, coal, and oil nonrenewable forms of energy?**

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