Return To Middle School Lesson Plans

Title: Fossil Fuels--Discoveries and Uses
Level: Middle School
Time: 45 minutes
KERA Goals: 2.2; 2.30; 2.33; 2.38; 2.6

Objectives:

To demonstrate to the student the close relationship between fossil energy and our daily lives. To demonstrate to the student the close relationship between fossil energy and our daily lives.

To Answer the Following Questions:
Who first discovered fossil fuels? Where did they find them? How did we use U.S. fossil fuels in the past? How do we use fossil fuels today? How do we make our fossil fuel resources last longer?

Time Allotment: 30-45 minutes

Students should be able to:

1. List at least two people from the past who either used or reported sighting fossil fuels.

2. List the dates and places that coal, natural gas, and petroleum were first used commercially in the United States.

3. Name the reason why Americans need both the natural gas and petroleum that came from the first commercial wells.

4. List at least 10 things that are made from or run on fossil fuels or fossil fuel products.

5. List three simple conservation methods that can be used to save energy.

Materials:

Dinosaurs and Power Plants
Fossil Energy products for the Introduction (option)
D&PP Teacher's Guide Supplement ("Supplement"),
Drawing- "The First Incandescent Lamp..."
Drawings (7)- "First Uses of Fossil Energy"
Drawing- "Today's Fossil Fuel Uses: Clock, Glasses, Telephone, School Bus, & Lawn Mower"
Drawing- "Fossil Fuels and Electricity"
Map- U.S. Strategic Petroleum Reserve Sites

Word List
"Fossil Energy Uses" List
"Things Powered by Electricity..." List
"Resource Conservation" List

Graphics for Fossil Fuels: Discoveries and Uses

Background Information:

Key Question: Do you know when and where fossil fuels were first discovered and used?

[and Answer] [Fossil fuels have been used since cavemen discovered how to burn peat (decayed plant materials that have not reached the coal stage) or coal for heat. Plutarch, a Greek historian, wrote about the "external fires" in the area of present day Iraq. These fires were probably caused by natural gas that was seeping through cracks in the ground and ignited by lightning. Alexander the Great burned petroleum to scare the war elephants of his enemies. The Egyptians used asphalt, a derivative of petroleum, to preserve human remains. The mummies seen in museums were produced using this process.]

Key Question: Can you tell me when fossil fuels were first utilized commercially in the United States?

Coal [Coal was discovered by explorers in 1673, but it was not mined commercially until the 1740's in Virginia. Before then, coal had been used by the Hopi Indians in the 1300's for heating and cooking. however, it was the Industrial Revolution that provided the real opportunity for coal to become the primary provider of energy for the Age of Machinery. Coal is still the number one fuel used to produce electricity. Today over half of the electricity in the United States is produced by burning coal in power plants. However, it was barely 100 years ago that burning coal became one of the leading ways to produce electricity so generation of electricity is a relatively new use for coal. Long after electricity was used for lighting, coal was still burned in home furnaces for heating and in stoves for cooking. It was also used for powering various types of transportation machinery, such as trains and ships.]

Natural Gas [Natural gas was first sought commercially in 1821, when William A. Hart drilled a 27 foot deep well in Fredonia, NY, to get a larger flow of gas from a naturally occurring surface seepage. This natural gas was sent through wooden pipes to nearby homes for lighting. These wooden pipes allowed some gas to escape and was not an effective way to send natural gas long distances. It was more than 100 years before an efficient distribution system allowed natural gas to be sent long distances to homes, factories, and businesses. As the people near these early wells could not use the large quantities of natural gas that was found and did not have good methods for containing the natural gas in the well, much of it was lost or wasted. For example, in towns with outdoor natural gas lighting, the lamps were left burning day and night.]

Petroleum [In 1859, Edwin L. Drake began the modern day petroleum industry in Titusville, Pennsylvania, when he drilled a 69 foot deep well and discovered crude oil. There was a

shortage of whale oil that was used for lighting in some homes and for lubrication of machinery gears in some industries. The crude oil that was obtained from this well was used to form kerosene to use in lamps for illumination and to form grease for machinery.

"Petroleum" is used to refer to crude oil and all oil products. "Crude oil" is the actual unrefined petroleum that reaches the surface of the ground in a liquid state.

Before this time, a number of uses had been made of the asphalt, tar, etc. from the above ground seepages of petroleum in the U.S., but one of the most important historical uses was when the survivors of theDeSoto expedition utilized pitch to repair and make their ships watertight.]

Key Question: How are fossil fuels used today?

[Fossil fuels touch every moment of our lives-when we wake up or sleep, when we eat, when we use our eyes to see, when we play or work, or when we are ill. For instance, petroleum not only can be refined into fuels, such as gasoline, to powers engines; it can also be separated into petrochemicals from which plastics, medicines, paints, etc. can be made. The plastic of the alarm clock that wakes us up can come from petrochemicals. The farmer who raises our food may depend on fossil fuels for fertilizers to make his crop grow. When we read our eyeglass frames or lenses may be of plastic made form petroleum. When we listen to a cassette player to telephone we are using equipment that is made from fossil fuels. The synthetic fibers that keep sheets on our bed from wrinkling are produced from fossil fuels. Photographic film for our cameral also is made from petroleum as are many medicines used when we are sick. When we go to work in an office much of the equipment, such as typewriter ribbons and computer disks, depend on fossil fuels for their composition. When we work in an industrial facility we may depend on coal to fuel the huge furnaces or petroleum products to lubricate the gears of the machinery.

We also depend on petroleum products for transportation when we ride a bus or other vehicle to school. Even the school we go to probably was built using fossil fuels, such as coal to manufacture the brick sand petroleum for the tarring and waterproofing the roof. The heat in our homes or schools may come from natural gas. Clothes dryers or water heaters may also use natural gas to heat the air or water. Even the lawnmower runs on gasoline or electricity that both come from fossil fuels.

Most of our lives depend upon fossil fuels - not just for the energy, such as the electricity we take for granted, but many times for jobs, such as steel making or building construction or bus driving, and sometimes even for the manufacturing of the clothes we wear on our backs.]

Can you find out what each of these people did that helped lead to our present system for generation of electricity? (Refer to each name or to "electricity" in an encyclopedia).

Key Question: How is electricity produced by fossil fuels?

[Many inventors paved the way to modern day electric generation. Some of these people,

the date of their work, and their country are: Thales (600 b.c. Greece), Benjamin Franklin (1752 USA), Andre Ampere (1820 France), Michael Faraday (1831 England), Zenobe Gramme (1870 Belgium), Thomas Edison (1880 USA), George Westinghouse (1887 USA), and Nikola Telsa (1890 USA).

Thomas Edison opened the Pearl Street steam electric Station on September 4, 1882, in New York City. It was the first commercial power station in the U.S. incandescent lighting. By October of that year, the station was providing 59 customers in a square mile area with electricity for lighting 1284 incandescent maps (electric lights) at about 25 cents per kilowatt hour. The station had a total capacity of 600 kilowatts. (Today's fossil fuel power pant may have a capacity of over one million kilowatts.)

Who can find out how much we pay today per kilowatt hour for electricity? (Check you home electrical bill or call your local electrical company.

Electricity was first produced in two kinds of power plants: Fossil fuel steam electric plants and hydroelectric pants (the first hydroelectric play opened on the Fox River in Appleton, Wisconsin, 26 days after the Pearl Street steam electric plant opened in New York).

Electricity today can be produced by your utility (electric) company at a power plant by burning a fuel, such as coal, to heat a large quantity of water in a giant closed tub (sometimes 15 stories tall) called a "boiler." As the water boils, it produces steam (like boiling water in a covered pan on your stove). The steam is collected at the top of the boiler and sent through pipes to another enclosure called a "turbine" that has large blades (somewhat like propeller blades on an airplane.).

The steam rushes in causing these blades - and the shaft the blades are mounted on - to turn. Since this turbine uses steam to turn the blades, it is called a "steam turbine." The rotating shaft in the turbine also extends into a last box called a "generator" where it turns a wire coil attached to it.

The generator also contains a magnet. The wire coil is inside this magnet. The electrical current that is generated by moving the wire coil inside the magnet is collected by the wire coil and sent out of the power plant as electricity to your school or home.

The electricity is carried by wires usually strung from pole to pole (sometimes referred to as "telephone poles" to your home.]

Key Question: Will our fossil fuel resources last forever?

[Fossil fuels we use today began to form millions of years ago. Due to several factors, such as the length of time required to form these fuels, increasing population, and wasteful usage, we are using fossil fuels faster than they are being formed. However, we still have enough coal, petroleum and natural gas on earth to last many years. In fact, within the U.S. boundaries, we have 1/4 of the world's supply of coal. That amount is enough to last, using today's consumption rates, approximately 300 years.

However, we are not so lucky when it comes to petroleum and natural gas. They are less plentiful, more elusive to find, and harder to get out of the ground. The United States uses each day an average of 16 million barrels of petroleum. We use more oil than we produce within our borders and have to buy oil from other countries. We have crude oil left in the U.S., but much of it is difficult or very expensive to get out of the ground.

The U.S. Department of Energy is funding research about how to get more oil out of these reservoirs at lower costs. The net lesson will cover some of these ways.

As of yet, we are still having to depend on foreign countries for much of our oil. The oil embargo of 1973- 1974 when many Arab nations cut off the oil flowing into the U.S. and created long waiting lines at our gas stations dramatically demonstrated the need for a national oil stockpile.

In the aftermath of the oil crisis, America established the Strategic Petroleum Reserve, an emergency supply of crude oil stored in underground salt dome caverns along the Gulf Coast in Louisiana and Texas. It is our national "insurance policy" in case of oil disruption emergencies and is the largest stockpile of crude oil in the world.]

SUGGESTION: Show the location of the Gulf of Mexico, Louisiana, and Texas on a classroom map of the United States or show the map found in the Supplement - Lesson 2.

Key Question: If we have this stockpile of oil and have an abundant supply of coal, why do we need to make our fossil fuel resources last longer?

[There are several reasons to help conserve our fossil energy resources, including:
1. The cost for heating, lighting, cooling, electricity, cooking, and fossil fuel products can consume a large portion of a household budget. The money we save by not wasting energy and fossil fuel products is money we can use in other ways.
2. The more fossil fuel products we use and throw away, such as plastic cups, disposable diapers, computer disks, the more solid waste we must bury or burn.
3. Your parents may have plenty of fossil fuels to use, buy what about later when you (age 10 now) are 25 years old? (15 years from now) Or your children when they are 25? (having a child at age 25 - only 40 years away) or you children's children? (just 65 years in the future)

We have to become more responsible in our use of all of our resources. We have to learn to think beyond today to tomorrow when we will have to face the consequences of what we do today. We have to think of the world we will live in tomorrow or we will leave for others. Even now, we are facing challenges caused by previous years of careless living. Without careful planning and consideration, we may have to face even more severe future challenges to the environment, our health, and the cost of living.]

Key Question: How can we make our fossil fuel resources last longer?

Resource Conservation [There are simple actions, called "conservation" methods, we can take to save energy and natural resources.]
1. Turn off lights when you leave the room and turn off the television or radio whenever you

go to do something else.
2. Decide what you want from the refrigerator before opening the door. Do not hold the door open for a long time and let the cold air out. Check to make sure you shut the door completely.
3. Whenever possible walk or ride your bicycle instead of taking a car.
4. Test your windows and doors to see if air leaks in or out. If it does, apply weather stripping to those with air conditioning in and reduce your utility bill.
5. Wear warmer or cooler clothing that allows you to set your thermostat lower in the winter (keep your home cooler) and higher in the summer (keep you home warmer).
6. Take short showers rather than baths to save on hot water (and wastewater that will have to be cleaned at the local water treatment facility).
7. Use as few disposable items as possible. The more items we throw away, the more land we will have to use for solid waste disposal. And the more it will cost you for collection and disposal of these waste items.
8. Recycle as many reusable items as possible. Recycling helps us reuse the resource that originally created the product rather than having to use more raw resources to make new products. For instance, recycling newspapers will reduce the number of trees required to make paper.
9. There are many other conservation methods that will help save our resources. Check with your local power company or recycling center for additional information.

Activity Options:
1. Half of the class will list things that are made from fossil fuels and half of the class will list things that run on fossil fuels. Determine which group produces the longest list.

2. Check the classroom for heating and cooling loss by producing a draft detector and checking the windows and doors in your room.

Activity 1:

Ask "What do we need to make it possible to have lights in our room?" Turn the lights back on.

[Energy or electricity.]

If answer was "energy" ask, "In what form does this energy exist?"

[Electricity.]
"Where does electricity come from?"

[It is produced in a power plant from fossil energy, nuclear energy, solar energy, etc. Over half of the electricity in the United States is produced form COAL, a fossil fuel rock.]

Display a group of fossil energy related items.

Items that were made from or use fossil fuels are needed for this Introduction

Activity 2:

Ask, "What do all these things have in common?"

[They were all made using fossil fuels. Fossil fuels were either used to power the machinery needed to produce the products or to heat the materials used in manufacturing the product. Fossil fuels are also used as the base materials needed to produce plastic, paint, tape, etc. For instance, petroleum is required to make plastics and many types of medicines.]

Stop and Think Exercise How many of you can remember when video games or personal computers were unheard of? What about air conditioning? Can someone in your family remember when on one they knew had television? Can another person in your family remember when there were no electric refrigerators and they had to buy ice every day to keep the food from spoiling? Have you ever asked someone how they traveled before cars, buses, and planes existed?

[Electricity for homes was not common until almost 1900 in large cities. It was around the date that most of our inventions that use electricity were created. Before then, many things we have now, such as washing machines, sewing machines, etc., were hand powered. When electricity first began to be distributed to homes, it was then, as now, mostly generated by burning fossil fuels. Some of the inventions made possible by electricity produced by fossil fuels, inventors, and dates are: electric (incandescent) light bulb (Thomas Edison & Joseph Swan - 1800), sewing machine (Isaac Singer - 1889), vacuum cleaner (1901), refrigerator (1917), & dishwasher (1918).]

Activity 3:

Making a Draft Detector

Cut out a piece of clear plastic food wrap about five inches by 10 inches. Tape the five inch end to a short stick so the long end hangs freely. For the stick, you could use a pencil or a ruler.

Test the draft detector by blowing very slightly on the plastic hanging down. Notice that even when you blow ever so lightly, the plastic moves and shows the movement of the air. Then hold the draft detector close to where the window or door meets its frame. Determine whether there are drafts stealing the heat or air conditioning from your room by watching to see if the plastic moves.

Follow-up Activities:

1. Write a letter to the local power company for information on what fossil fuels it uses to generate electricity and on how much electricity various appliances and audio equipment use per hour.

2. Write a story about a day in the life of a pioneer student without electricity, central heat, cars, video games, television, radio, etc.

3. Give a report on how much it costs to run the family vehicle for one year.

4. Clip pictures at home (for the collage) of things that are run on fossil fuels (e.g., refrigerator) or things that are made from fossil fuels (e.g., plastics, paint, medicines, adhesives, etc.).

5. Each time you use something that uses electricity or a fossil fuel, write down its name (e.g., TV, radio, car, hot water [heater], lights, refrigerator, toaster, microwave, garage opener, telephone, escalator, bus, computer, etc.) and the type of fossil fuel.

6. Ask a resource speaker from the local power accompany to discuss energy resources, uses, and conservation.

7. Write the U.S. Department of Energy Office of Conservation and Renewable Energy for information on ways to conserve energy.

8. Write a report on automated inventions (no later than 1930) that were made possible by electricity produced from fossil fuels and on the inventors of these machines.

9. Talk to relatives and older fiends to find out what people did before electric washing machines, refrigerators, televisions, radios, typewriters computers, fans, air conditioners, elevators (how tall were buildings before there were elevators?), lights, etc. were available to the average person. What did they do without buses, cars, trucks, and airplanes that are powered by fossil fuels?

10. Practice spelling words from the words list for this lesson (found in the Supplement) or write a definition for each word or word group.

11. Determine how much the lights in you classroom/school cost per year.

Provided by Department of Energy and the Office of Fossil Energy