

SAMPLE MATERIALS

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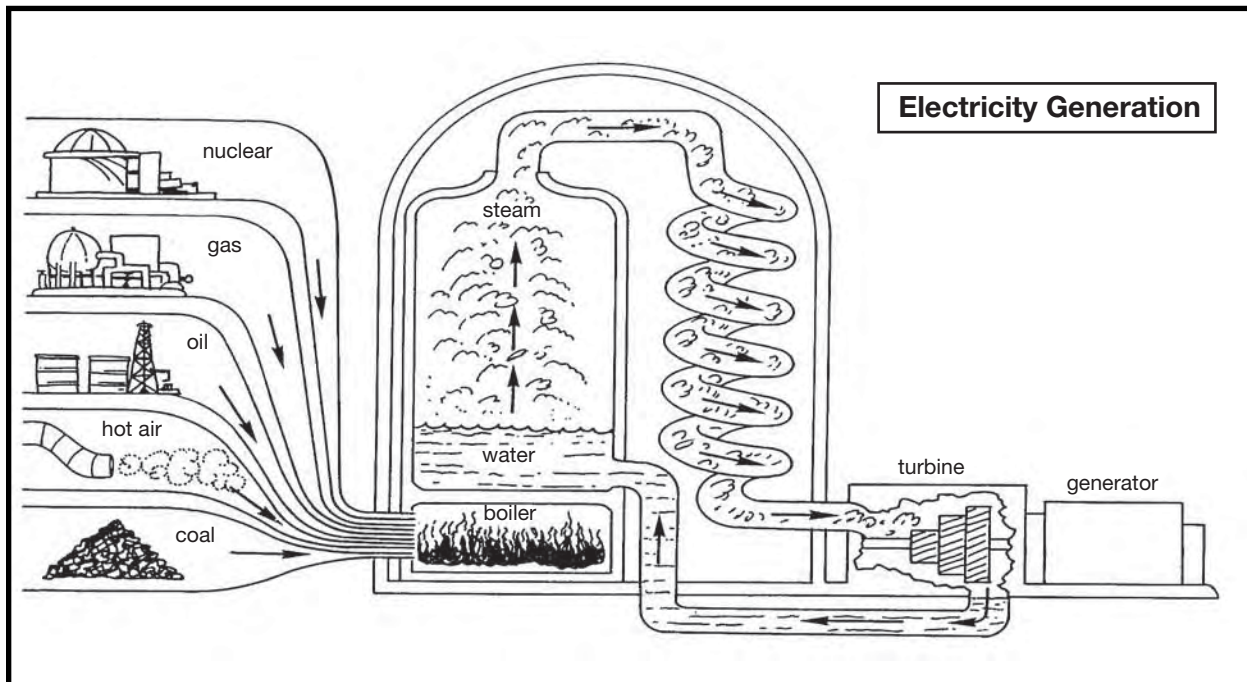
Teaching Opportunity®

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Teaching Procedure:

Introduction to Electricity Generation

1. Construct a word web/concept map on energy using the blackboard or chart paper. Initiate the discussion with this statement: "Energy exists in every produced item." Have students look around the room to name items which use energy or were produced by the use of energy. Group items around categories of lighting, heating/cooling, machines (clock or computer), and the manufacture of goods (desk, chair).
2. Explain the difference between a **primary source** of energy (coal, uranium, oil, wind, etc.) and a **secondary source** (electricity). Discuss whether energy should be considered **scarce**. (*Yes, it takes scarce productive resources to produce. It is not freely available in unlimited quantities. One must pay to obtain it.*)
3. Use the diagram below to explain electricity generation. Tell students that primary sources, such as coal, oil, uranium (in a reactor), or natural gas, are used to generate heat and steam. Other primary sources, such as wind and water, turn the turbine directly. Explain how the turbine turns the electromagnet in the generator to produce electricity, which is a secondary energy source.



4. Let students use motions to represent various steps in electrical generation. Steps could include mining, refining, transporting, generation, transmission, etc. Put signs on students identifying what part of the process each student represents.
5. Have students explore this excellent website about electrical energy: The Electric Universe (www.electricuniverse.com).

6. Have students learn about all kinds of energy sources at this great site: Energy Kid's Page - <http://www.eia.doe.gov/kids/energyfacts/index.html>
7. For great electrical energy information, go to Electricity InfoCard2004 at <http://www.eia.doe.gov/neic/brochure/electinfocard.html>

Map Activity

1. Pass out the U.S. maps and Energy Sources Information Sheet. Identify each state. Students then color code the map to show what type or primary energy is used *most* to generate electricity in that state.
2. After the students have completed the map, discuss why certain types of energy are used in certain states and regions. What source is used most? (*coal*) What factors, besides the local availability of the energy resource, could influence the type of energy used? (*market price of different energy sources, government regulations, transportation costs, political factors*) If a state did not have enough electricity generated locally, what could it do? (*import electricity from another state, region, or country*)

Teaching Tips:

1. Use a pinwheel to illustrate how a turbine works.
2. For younger students, use maps which have state names.

Key Questions To Ask Students:

1. "All producers and consumers use energy." True or False? (*True! Have students give examples.*)
2. Why is energy considered a scarce resource? (*It is not freely available in unlimited quantities. It takes scarce productive resources to produce it. One must pay to obtain it.*)
3. What is the difference between a primary and secondary energy source? (*Primary sources are direct renewable or nonrenewable sources that are used to produce secondary sources, such as electricity.*)
4. Why does a state use a particular primary energy source to generate electricity? (*States typically use primary sources that cost less because they are available locally.*)

Bulletin Board Ideas:

1. Recreate the electricity generation diagram. Put the names of the different primary energy sources on index cards and place them where the energy is used in the generation cycle. (Example: put a "wind" index card near the turbine, an "oil" card near the heat source, etc.) Have students write descriptive paragraphs explaining how electricity is generated. Put these on the bulletin board.

Student Journal Ideas:

1. Explain the difference between primary and secondary energy sources.
2. Draw a picture showing how electricity is generated. Write a paragraph explaining the picture.
3. Write a paragraph explaining why you agree or disagree with this statement: “There is a lot of energy. Energy is *not* a scarce resource.”

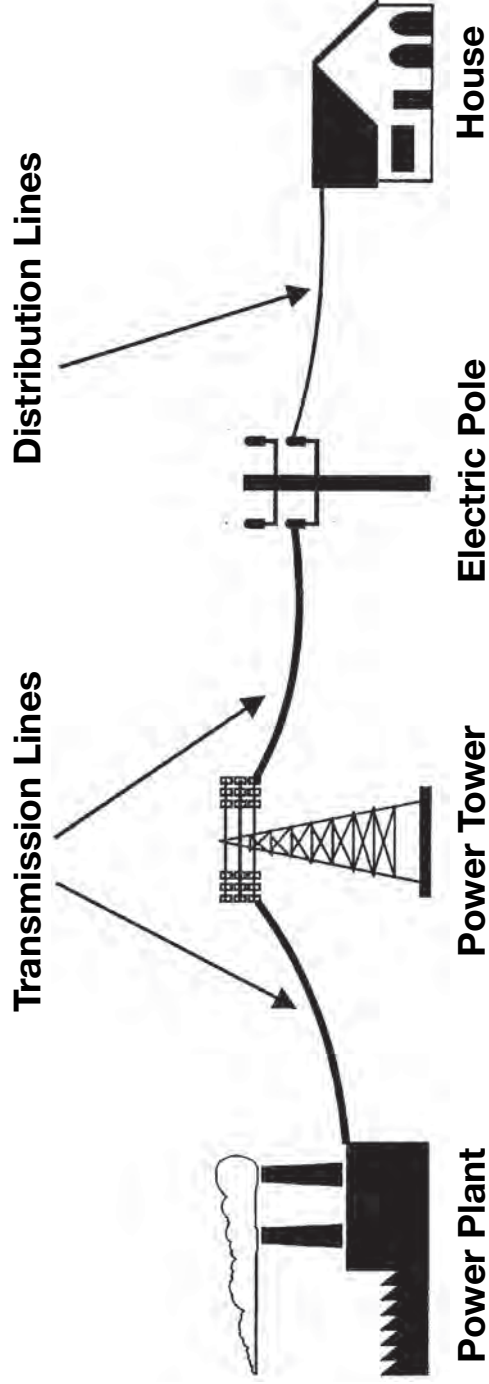
Energy Sources Information Sheet

Primary Energy Sources Used *Most* to Generate Electricity by State:

Alabama	Coal	New Hampshire	Nuclear
Alaska	Natural Gas	New Jersey	Nuclear
Arizona	Coal	New Mexico	Coal
Arkansas	Coal	New York	Nuclear
California	Natural Gas	North Carolina	Coal
Colorado	Coal	North Dakota	Coal
Connecticut	Nuclear	Ohio	Coal
Delaware	Coal	Oklahoma	Coal
District of Columbia	Petroleum	Oregon	Hydroelectric
Florida	Coal	Pennsylvania	Coal
Georgia	Coal	Rhode Island	Natural Gas
Hawaii	Petroleum	South Carolina	Nuclear
Idaho	Hydroelectric	South Dakota	Hydroelectric
Illinois	Nuclear	Tennessee	Coal
Indiana	Coal	Texas	Natural Gas
Iowa	Coal	Utah	Coal
Kansas	Coal	Vermont	Nuclear
Kentucky	Coal	Virginia	Coal
Louisiana	Natural Gas	Washington	Hydroelectric
Maine	Natural Gas	West Virginia	Coal
Maryland	Coal	Wisconsin	Coal
Massachusetts	Natural Gas	Wyoming	Coal
Michigan	Coal		
Minnesota	Coal		
Mississippi	Coal		
Montana	Coal		
Nebraska	Coal		
Nevada	Coal		

Source: State Electricity Profiles, 2002,
Energy Information Administration.
www.eia.doe.gov

Electricity



Electricity is the flow of electrons through wires.

Activity 3

Energy Search



Teaching Objectives: After completing this activity, students will:

1. Identify and define the three basic productive resources.
2. Explain that the search for energy sources will necessarily impact the environment.
3. Explain why the marginal cost of finding and extracting energy resources eventually increases.
4. Predict that as the cost of fossil fuels increases, other energy sources will be used.
5. Explain why we will never “run out” of nonrenewable energy resources.

Time Allowed: 30 minutes

- Materials:**
- Four colors of beads (100 black, 6 red, 20 white, 74 blue)
 - Several tablespoons of cornmeal
 - 1/4 cup of oatmeal

Vocabulary:

- *Scarcity*: the condition of not being able to have all of the goods, services, or productive resources that you want. Energy is considered *scarce* because it is not freely available in unlimited quantities.
- *Price*: the amount people pay to buy a good, service, or productive resource. Prices reflect *relative scarcity*. Items which are more scarce generally cost more than those which are not.
- *Productive Resources*: the inputs (natural, human, and capital) needed to produce goods and services

Energy is used in all production and consumption. Energy resources are **scarce natural resources** and must be extracted from nature to be used. Locating and extracting energy resources will always impact the environment to some degree. Repairing environmental damage increases the cost of producing energy.

There are still vast quantities of nonrenewable energy resources in the earth’s crust. However, as companies search for and extract energy resources it typically becomes more costly, since the resources are more difficult to find, are located in more inaccessible places, etc. If a nonrenewable resource becomes relatively more **scarce**, its **market price** will rise, causing consumers to use less. The high price makes the use of alternative energy resources more attractive and encourages their development. This is why we will never “run out” of energy.

Teaching Procedure:

1. While students are out of the room, randomly scatter the beads, cornmeal, and oatmeal. Hide some of the beads and cornmeal under items to make them more difficult to find.
2. Divide the class into six energy companies. Each company will search for a specific material (color of bead, oatmeal, or cornmeal). Explain that you have thrown an unknown quantity of energy resources in the classroom. Students must recover as much as possible within a given period of time. Let the companies meet to discuss “mining” strategies.
3. Have companies conduct a one-minute energy search. Then reassemble the companies. Have them count their beads or measure the amount of oatmeal or cornmeal. Record the totals for each company on the blackboard or overhead.
4. Start a second one-minute search for any resources not yet found. Each company must make a new pile of any newly found resources. Reassemble and record totals.
5. Start a third one-minute search and record results.
6. Discuss questions in the Key Questions To Ask Students section below.

Teaching Tips:

1. If you increase the number of beads, keep them in the same proportions.
2. The beads can represent specific energy sources: black – coal; white – natural gas; red – uranium; blue – petroleum; cornmeal – solar; oatmeal – hydropower. The cornmeal is diffused and hard to gather. This represents the high cost (in terms of productive resources) of producing solar energy. Until these costs decrease, solar will not be as widely used as other sources.
3. If any company gathers some other colors, do not interfere or comment.
4. Adjust the amount of search time if students locate the beads too quickly.

Key Questions To Ask Students:

1. What productive resources were used in your energy search? *(Mainly labor was used. In real life, it also takes a lot of capital, such as drilling equipment, etc.)*
2. What do you notice about the piles of beads? *(They are smaller in each round.)*
3. Which search cost your company more? Why? *(The second and third. The beads were harder to find. In the same amount of time, we gathered less. People may not have looked as hard.)*
4. What made the beads easier or more difficult to find? Was it the availability of the beads or the skill of the searchers? *(Both are important.)*