Unit 3 Grades K-3

Protecting Earth's Resources:

Renewable vs. Non-Renewable Energy

RENEWABLE ENERGY THE INFINITE POWER OF TEXAS

OVERVIEW

In Units 1 and 2, students explored energy and developed a sense of how they use it in their school and at home. This unit will focus on developing the concepts of renewable and non-renewable energy. Activities will illustrate the difference between renewable and non-renewable energy and students will see how energy is generated from the sun, wind, earth and water.

OBJECTIVE

The objective of this unit is for students to begin to understand the difference between renewable and non-renewable sources of energy and experience how renewable energy can be used.

SUGGESTED TIMEFRAME

Days	Time	Activity Title	Content Knowledge	Process Skills
1	45 minutes	Fossil Fuel Search	Science, math, social studies	Engage
2	45 minutes	Sun Power	Science	Explore and Explain
3	45-60 minutes	Wind Power	Science	Explore and Explain
4	45-60 minutes	Geothermal, Hydroelectric, and Nuclear Chain Reactions	Science	Explore and Explain
5	30-45 minutes	Renewable or Non-renewable?	Science, math	Evaluate

MATERIALS FOR THE WEEK

200 pennies, piece of coal, toy pinwheel, data sheet, four three-ounce plastic cups per pair of students, permanent markers, overhead projector, blank transparencies, overhead transparency marker, tea bags, large glass jar, graham crackers, miniature marshmallows, two plain chocolate candy bars, tin foil, box of crackers (saltines or Wheat Thins), straws, brads, crayons, pot for heating water, hot plate, tin foil, nail or something to punch holes, milk carton, masking tape, dominos

DAILY ACTIVITIES

Day 1: Fossil Fuel Search (www.powerhousekids.com)

Prior to the class, hide 200 pennies around the room. Make sure that some are hidden in very obscure places. Begin class by showing a piece of coal and asking for student volunteers to tell what it is and what it is used for. Lead the students to classify it as a source of energy that must be burned to release energy. Demonstrate the movement of the pinwheel by blowing toward it. Again, ask students to identify the source of the energy. (If they say "you," be sure to translate that into "wind" or "nature.") Also, ask how the pinwheel uses the wind — how it is captured or harnessed. Students should be able to recognize that the shape of the pinwheel creates the rotation when a current of air strikes it. Ask students to suggest which one of the energy sources is more likely to run out of its supply. In comparing the two energy sources, students should explain why they think one will likely run out and the other is not likely to run out. Label the two energy sources: non-

renewable (coal) and renewable (wind). Put up the overhead to complete the definitions of nonrenewable and renewable resources.

Arrange students in pairs and hand out the data sheet, plastic cups and markers. Have them label the cups 1 through 4. Tell them that they are going to be searching for a nonrenewable source of energy (such as the coal discussed earlier) symbolized by pennies hidden throughout the classroom.

Give students four 30-second opportunities to find pennies. After each search, have them count, record, and deposit the pennies into a cup (one labeled for each search). At the end of their four searches, they should make a bar graph and analyze their data.

When the paired groups have completed the data sheet, ask for volunteers to share their results. Once a few pairs share similar results, lead the class in a discussion. Through the data, students should be able to deduce that, due to a limited supply, the search yielded smaller returns each time.

Ask questions such as: Look at your graph. In which search did you find the most pennies? What is the difference between the number of pennies you found

in your tallest graph and your shortest graph? Why do you think it became increasingly harder to find pennies? If you were really searching for coal, what do your graph data tell you?

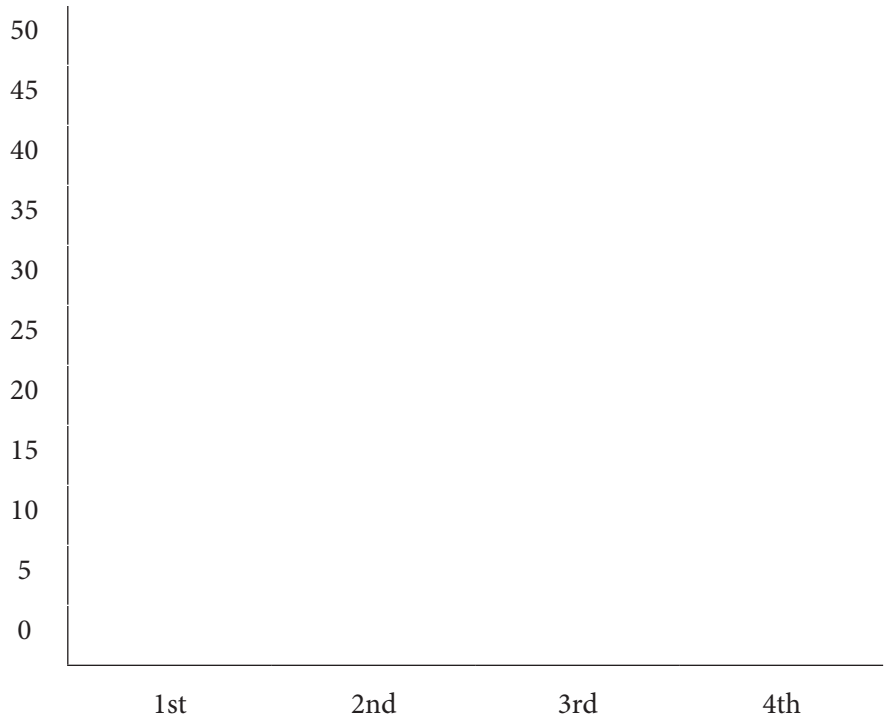
Fossil Fuel Search (Master)

First search _____

Second search _____

Third search _____

Fourth search _____



Day 2: Sun Power

Revisit the concept of renewable versus non-renewable energy. All the energy we use comes from the earth. The electricity we use every day doesn't come directly from the earth, but we make electricity using the earth's resources, such as coal or natural gas. Both coal and natural gas are called "fossil fuels" because they were formed deep under the earth over millions of years. The problem is that fossil fuels can't be replaced – once we use them up, they're gone forever. Renewable energy, on the other hand, is made from resources that will be naturally replaced like wind, water and sunshine. Renewable energy is sometimes called "clean energy" or "green power" because it usually doesn't pollute the air or the water.

This week we're going to explore how some of these natural resources create energy. The first one we'll explore is the sun.

Sun Tea

Fill a large glass jar (or two, so you have enough for the whole class) with cold water. Have students check the temperature of the water. Add one or two tea bags (decaffeinated) or more for a very large jar. Cover the jar with a lid and place it in a sunny spot. In about an hour, remove the bags and pour the tea over ice for each student. Check the temperature again and ask students to describe what happened and why they think it happened. What was the energy source? Have students record the process and results in their science notebooks.

Smores

While the tea is brewing, prepare your smores. This activity works best when the outdoor temperature is 85 degrees Fahrenheit or higher. Have each student place their graham crackers side by side on a piece of aluminum foil large enough to wrap the smores when the assembly is complete. Place a chocolate bar on two of the graham crackers. Place eight mini-marshmallows on top of the chocolate. Make a sandwich with the graham crackers. Wrap in tin foil, have students write their name on the top and place the smores outside in the sun. Wait for the marshmallows and chocolate to melt. Enjoy ice tea and smores made from solar energy. Have students record the process and results in their science notebooks.

Day 3: Wind Power

Spin the Cracker (http://www.eia.doe.gov/kids/classactivities/SaltinePrimary.pdf)

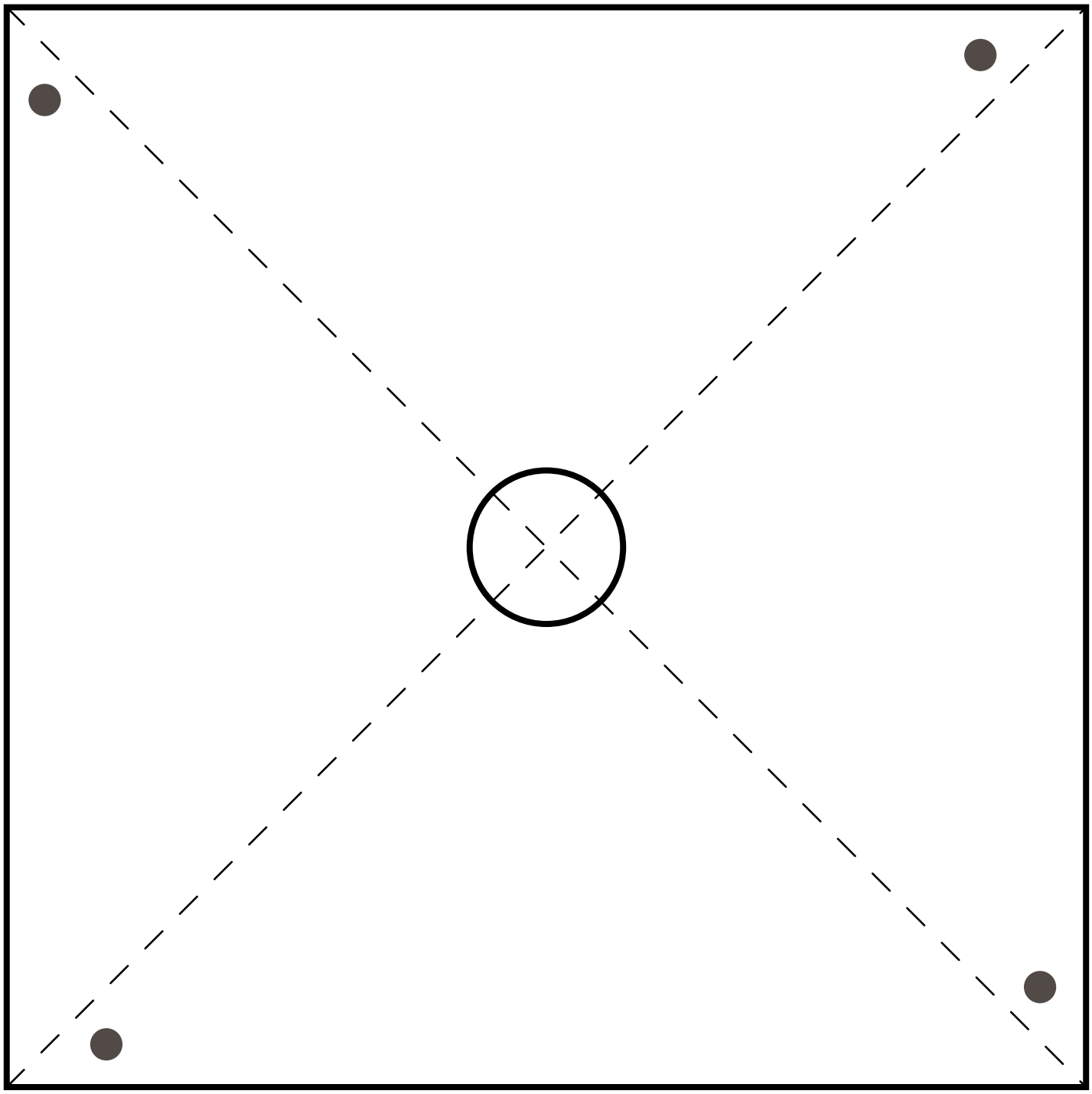
Provide each student with an unbroken saltine cracker. Make sure the corners of the crackers are sharp. Demonstrate how to hold diagonal corners of a cracker gently between your thumb and index finger, as shown in the picture below. Blow on the outside corner and the saltine will spin like a turbine. Direct the students to hold their crackers very gently and blow on the outside corner. Explain to the students that the energy in the moving air is spinning the cracker. Direct the students to blow very lightly, then harder and harder, to see what happens. Explain that windmills work on the same principle. The blades of a windmill convert moving air, called wind, into a spinning motion that spins a turbine. The turbine spins a magnet inside a coil of wire to produce electricity. Have students record the process and results in their science notebooks.

Testing a Pinwheel Turbine

Cut-out the pinwheel on the solid lines only. Decorate both sides of the construction paper pinwheel. Cut the dotted lines from the four corners to the center circle. Try not to cut into the center circle. Use a sharpened pencil to poke a hole through the four tiny dark circles. The pencil point also works well to poke a hole into a straw. Carefully push the pencil point through the straw about 1/2 inch from the top. Make the tiny holes on the four points meet at the center circle. Push the ends of the paper fastener through the holes on the pinwheel then push the fastener through the center circle. Place the straw on the back side of your pinwheel and push the ends of the fastener through the hole in the straw. Open-up the fastener by flattening the ends in opposite directions. Now you are ready to try-out your beautiful pinwheel. Just blow! Have students record the process and results in their science notebooks.

Note that the next page has the pinwheel pattern.

Pinwheel Pattern



Day 4: Geothermal, Hydroelectric and Nuclear Chain Reactions (www.energyquest.ca.gov/projects/index)

Geothermal Power Plant

Put water into the pot and cover the top of the pot with two layers of tin foil. Tightly crimp the tin foil around the edges so it seals the top tightly. Using the nail, punch a hole in the top of the tin foil cover in the very center about 1/16 inch across. Put covered pot to side. Put the pot onto the hot plate and bring to a boil. Put on the mitten pot holder, and when steam starts coming out of the top, carefully hold the pinwheel over the one hole. Notice how fast the wheel spins. Have students record the process and results in their science notebooks.

Hydroelectric Power Plant

Facilities are built at the base of dams to take advantage of the high pressure of the water at the bottom of a reservoir. The water pressure is funneled through a tunnel through the dam called a penstock. The water then is focused on the blades of a turbine. Water pressure of the water turns the turbine, and the turbine turns a generator making electricity.

Cut off the top of the milk carton. From the bottom of the milk carton, measure up 1/2 inch and, using the awl or 10p nail, punch a single hole in the center of the side of the carton. Measure up one inch from the bottom and punch another hole in the center.

Measure up two inches from the bottom and punch a third hole directly above the other two holes. Measure up four inches from the bottom and punch a final hole in the center of the side. **NOTE:** All holes should be the same size. Take a long piece of tape and tape up all four of the holes. Put the carton on the edge of the sink with the side with the holes pointing toward the sink (or a wash basin). Mark a line on the carton near the top. Always fill or refill the milk carton with water to that line. Quickly remove the tape that's covering all the four holes. Watch what happens. Measure how far away each of the steams hits the sink. Let all the water empty out. Watch what happens as the water level drops. What happens to the streams of water? Now tape up all holes. Put the carton back on the sink edge. Refill the carton and remove the bottom tape. Measure how far out the stream goes. Re-tape the hole and un-tape the next hole up; measure how far away the stream goes. Refill the carton with water. Re-tape the second hole and un-tape the third hole; measure how far away the stream goes. Refill the carton with water to the same level as before. Re-tape the third hole and un-tape the fourth hole; measure how far away the stream goes.

Ask students, How far away did the streams of water fall from the carton? Was there a difference between the streams of water from the hole at the bottom and the hole at the top? Here's why: water has weight. The closer to the bottom of the carton, the more water is above and the more weight is pressing down from above. The more weight, the more water pressure. And the more water pressure, the further away the stream will go and the faster it will go. (Note that some differential is also expected because the water is coming out of the holes from different heights.) Have students record the process and results in their science notebooks.

Nuclear chain Reaction

In a nuclear fission reaction in a nuclear power plant, the radioactive element Uranium-235 is used in a chain reaction. The fission of U-235 splits off two neutrons that in turn strike two U-235 atoms. Two neutrons are split from each of the two U-235 atoms. Each of these neutrons then goes on to strike another U-235 atom. Each of those atoms are split, releasing two neutrons, which go on to hit more uranium atoms. The chain reaction continues on and on, getting bigger and bigger with each split. The things that slow down a chain reaction are the control rods. A control rod is made up of cadmium or boron, which absorb neutrons. If you insert the control rod between the uranium atoms, the amount of neutrons available to cause more splits is reduced. We can illustrate this simplistically with dominos.

Arrange two straight lines of dominos. Knock over the first domino in one of the two straight lines. Take the ruler and hold it anywhere between the dominos lined up in the second straight line. Knock over the first domino and watch what happens. Not all the dominos fell over. In the second line up of dominos, the ruler served as a control rod. Putting it between two dominos breaks the chain reaction, similar to what happens in a nuclear reactor. Give small groups of students a bag of dominos. Ask students to see how long a chain they can make so that all

the dominos in the chain fall over. Have students record the process and results in their science notebooks.

Day 5 Renewable or Non-Renewable?

The cards on the next page provide students with opportunities to play a number of common card games and see if they can categorize renewable and non-renewable sources of energy.

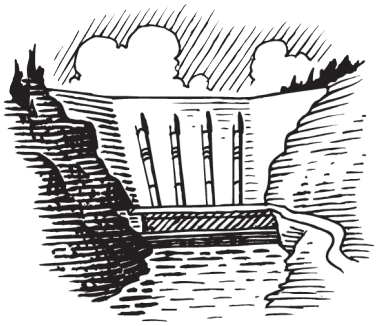
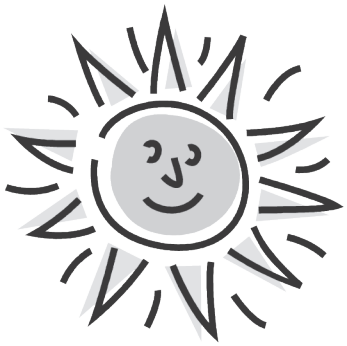
Game #1: Renewable non-renewable Sort. Provide one set of pictures to each student and ask them to cut and sort the pictures by renewable (sun, wind, earth, water) and non-renewable (oil, nuclear, coal, natural gas).

Game #2 – Go Renewable. Provide one set of pictures to each student and ask them to cut and combine their cards. This could be played with teams or multiple students as well. Students will play a version of "Go Fish" called "Go Renewable." Students deal three cards to each person with the remaining cards in a pile in the center. Each person asks the person to their left if they have one card in their hand. If that person has the card, they must give it to the person asking. If they don't they say, "Go Renewable" and the person picks a card from the center. Play continues until all the cards are gone from the center and all the sets made. The person with the most renewable pairs at the end of the game wins.

Game #3 – Renewable Matching Game. Provide one set of pictures to each student and ask them to cut and combine their cards with one other person. Students mix the cards and lay them out face down. Each student chooses two cards to turn over; if they are different, they turn them back over; if they are the same they get to take those cards. When all the cards are matched, the one with the most renewable pairs wins.

Game #4 - Old Sun. Provide one set of pictures to each student and ask them to cut and combine their cards with one or two others. Leave only one sun in the deck and put the others to the side. Deal all the cards. Like "Old Maid," students will each take turns taking a card from the person to their left. If they get a match, they take it out of their hand and put it down beside them; if it's not a match they hold it in their hand. When all the matches are made and cards are gone, the one with the sun wins.

Renewable or Non-Renewable?

Wind	Heat from the Earth	Nuclear
 Water	**Renewable or Non-Renewable**	Coal
Oil	Natural Gas	 Sun