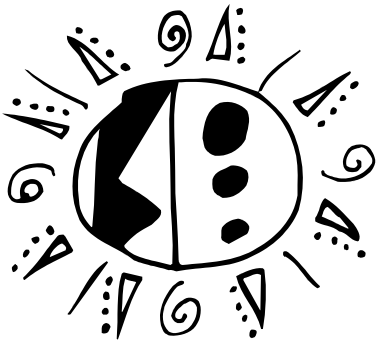
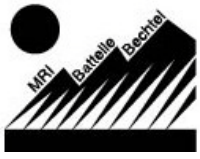
FUN WITH THE SUN

TEACHER'S ACTIVITY GUIDE
for
ELEMENTARY GRADES K-2



National Renewable Energy Laboratory
Education Programs
1617 Cole Blvd.
Golden, Colorado 80401
Tel: (303) 275-3044
Home page: http://www.nrel.gov



ACKNOWLEDGMENTS

The Education Program Office at NREL would like to thank the following individuals for their commitment and hard work in the testing and revising of this activity kit. The expertise of these educators was invaluable in producing a final product that attempts to be "user friendly " Their open-mindedness and willingness to try all the activities with their students generated productive feedback that will, we hope, continue as more teachers use these materials.

Susan Fields, *First Grade Teacher, Little Elementary, Jeffco School District*
Sue Ginsberg, *First Grade Teacher, Van Arsdale Elementary, Jeffco School District*
Carol Prekker, *Second Grade Teacher, Little Elementary, Jeffco School District*
Fran Tarchalski, *Second Grade Teacher, Eiber Elementary, Jeffco School District*

A special thank you also is extended to **Professor James Schreck,** Department of Chemistry and Biochemistry at the University of Northern Colorado for his assistance in the development of these kits.

It is the goal of the Education Programs Office to make these kits accessible, easy to use, and fun. We want your students to gain, not only an understanding of renewable and nonrenewable energy resources, but a greater confidence in investigating, questioning, and experimenting with scientific ideas. Your feedback on the evaluation form found at the end of this packet is very important for us to continue to build and improve this kit.

If you have questions, please call Linda Lung, Education Programs Office, (303) 275-3044 or e-mail: linda_lung@nrel.gov.

TO THE EDUCATOR

This activity kit was developed by the Education Programs Office at the National Renewable Energy Laboratory. Activity kits are available for grades K-6 in response to numerous teacher requests. *Users of these kits should practice appropriate safety guidelines in doing demonstrations or hands-on activities.*

STATE CONTENT STANDARDS

This kit addresses guidelines of the Colorado Science Standards with respect to Standards 1, 2, and 5:

> 1.0 Students understand the processes of scientific investigation, and design, conduct, communicate about, and evaluate such investigations.
>
> 2.0 Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)
>
> 2.2 Students know that energy appears in different forms, and can move (be transferred) and change (be transformed).
>
> 2.3 Students understand that interactions can produce changes in a system, although the total "quantities of matter and energy remain unchanged.
>
> 5.0 Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.

ASSESSMENTS/RUBRICS

Task assessments follow each concept in this kit. These assessments provide just *one* method of evaluating each student's grasp of the major concepts presented in previous activities. Teachers are encouraged to use these assessments as-is or to develop their own assessments that meet the individual needs of the students. The tasks in this kit usually involve open-ended, problem-solving activities but some will require recall of content knowledge.

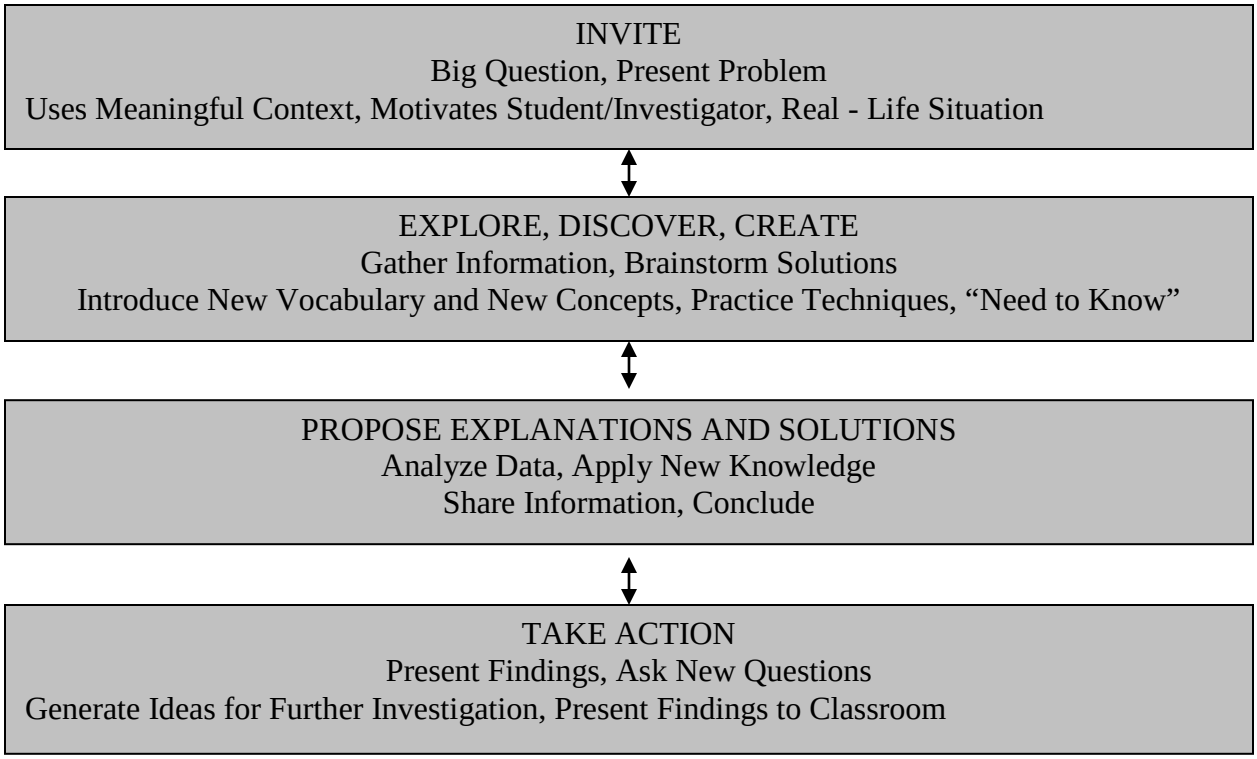
Included with each assessment is a standard, generic rubric. These rubrics are established as *guidelines for performance.* They also are a useful form of self-evaluation because they let the student know what is expected for high quality work. Harriet Yustein, a teacher from Suffem, New York, states that, "Through experience I have found that the best rubrics come from the children themselves. You should model what you want them to do and then they will discuss exactly what you want from them. That will be their rubric."

CONCEPTS
This activity kit is designed for elementary grades K-2, and is appropriate for discussion of energy concepts at these grade levels. The concepts developed through the activities in this kit include:

- energy classification (form, source, nonrenewable and renewable),
- uses and limits of energy,
- conversion of energy forms,
- conservation of energy, and
- future energy resources.

TEACHING- LEARNING MODEL
Each activity follows a format developed by the National Center for the Improvement of Science Education. The model is based on the "Immersion Approach" where teachers actually complete research projects in a laboratory setting. Once teachers have experienced "real life" laboratory research, they are more familiar with how they solve scientific problems. The Teaching-Learning Model is the result of these lab experiences. Rather than taking a cookbook approach to doing activities, teachers have found that students learn content ~ process through these steps:

TEACHER-LEARNING MODEL



ACTIVITY OUTLINE

Energy Classification	Activity 1 Sunbeams Activity 2 Energy Collage Activity 3 Where Does It Get Its Energy? Task Assessment #1
Energy Uses/Limits	Activity 4 Do Electrical Appliances Save Time? Activity 5 Safety with Electricity Task Assessment #2
Energy Conversion	Activity 6 A Bright Idea Task Assessment #3
Energy Conservation	Activity 7rrask Assessment #4 Saving Energy
Energy for the Future	Activity 8 Wind Detectives Student Assessments

RESOURCES

A Teacher's Background is included to help teachers with basic energy concepts, and to help them be more knowledgeable and comfortable in discussing these concepts with students. A Student Assessment is provided.

Materials found in this curriculum packet were adapted from several sources (no longer in print) including:

*"Teach With Energy! FUNdamental Energy, Electricity and Science Lessons for Grades K-3," National Energy Foundation, Utah.

* "Energy Conservation Activities for the Classroom K-12," Kentucky Department of Education. *"Science Activities in Energy," U.S. Department of Energy, Washington DC.

*"Award Winning Energy Education Activities for Elementary and High School Teachers," U.S. Department of Energy, Washington DC.

*"Iowa Developed Energy Activity Sampler K-12," Energy Division Iowa Department of Natural Resources.

*"Energy Activities for the Primary Classroom," California Energy Extension Service.

TEACHER BACKGROUND

The following information is provided as a resource to the teacher. It is intended to address the topics that will be discussed in the classroom during these eight activities. More specific information is provided at the beginning of some activities to help focus on the important points. There are, of course, many more resources to consult should you be interested. Please contact the Education Programs Office at the National Renewable Energy Laboratory, (303) 275-3044 for more information.

INTRODUCTION-- WHAT IS ENERGY?

Energy gives us the ability to do things such as climb a mountain, play soccer, and even think. And there are many types of energy--some is stored in our muscles and brain cells, some is used to move around and play, while other types of energy are used to light a street lamp, heat or cool our homes, cook our food, and power buses, planes and cars.

Energy causes movement. Every time you see something move, energy is being used. A leaf moving in the wind, a pot of boiling water, and a school bus traveling to school are all evidence of energy being used.
You know that energy exists because you can see or feel what it does. Energy moves cars, makes machines run, heats ovens, and lights our classrooms.

One form of energy can be changed into another form. When gasoline is burned in a school bus engine, the energy stored in gasoline is changed into heat energy. When we stand in the sun, light energy is changed into heat. When you turn on a flashlight, chemical energy stored in the battery is changed into light and heat.

To find energy, look for motion, heat, light, sound, chemical reactions, or electricity.

While there are two types of energy, *renewable and nonrenewable,* most of the energy we use comes from burning nonrenewable fuels--coal, petroleum or oil, or natural gas. These supply the majority of our energy needs because we have designed ways to transform their energy on a large scale to meet consumer needs. Regardless of the energy source, the energy contained in them is changed into a more useful form - electricity.

WHY DO WE MAKE ELECTRICITY?

We make electricity to provide energy for a lot of things. In fact, we often take electricity for granted because it is such an important part of our life style. It makes our everyday endeavors convenient and practical. For example, electricity makes alarm clocks ring in the morning to wake us for school, keeps food cool in the refrigerator so that cereal tastes good with milk, operates the blow dryer that styles hair, and runs the furnace that blows warm air throughout our homes in the winter to keep us warm while we get ready for school.

HOW DO WE MAKE ELECTRICITY?

One of the fossil fuels (usually coal) is burned in a power plant to heat water. The hot water turns into steam and forces a machine called a turbine to turn. The turbine powers a generator into electricity, which is sent through power lines to provide energy for buildings of all types.

In summary, *coal -hot water -steam -turbine -generator -electricity.*

Electricity can also be made from windmills or from water behind a dam. Falling water or rotating windmill blades will cause turbines to generate electricity.

WHY IS IT IMPORTANT NOT TO WASTE ENERGY?

In any energy conversion process, energy is *not* changed in *quality.* You can observe this by standing near an idling school bus engine. The engine gets very hot! Not all the chemical energy stored in the gasoline is converted into mechanical energy that moves the bus. Some energy is changed into heat energy that warms the air surrounding the engine. So, some of the energy stored in the gasoline is wasted. The *quality* of the original energy put into the process is not the same as the energy released.

The amount of fossil fuels is limited (no new reserves of these ancient fuels is being produced) and we will eventually run out of current supplies. It is important to conserve (save) these resources, while we experiment with the possibility of using renewable resources to meet our energy needs. Scientists at NREL are looking for ways to meet our energy needs using renewable energy sources. In the meantime, it is important that citizens not waste energy in any form. All of us need to be aware of things we can do to minimize the loss of energy .If the energy is lost, we don't have it available to use when we need it.

WHAT ELSE CAN WE USE FOR ENERGY?

Use of fossil fuels to make energy changes is complicated by the fact that they are the primary causes of environmental pollution including smog, acid rain, and the Greenhouse effect. Smog is formed when exhaust fumes of cars and buses mix with sunlight. The resulting thick, brown haze can be seen over some cities on occasion in winter. It can irritate eyes and lungs. Acid ~n is caused by the sulfur present in coal. When coal is burned to generate electricity, the sulfur is changed into a gas that will dissolve in water and fall to ground as rain or snow. The acid formed in acid rain is like that in lemon juice or vinegar. Acid rain can damage buildings and statues made of stone, trees, and food crops. The greenhouse effect arises when too much carbon dioxide from burning fossil fuels is produced. Increased amounts cause a warming of the atmosphere surrounding the earth much like that in a greenhouse. Too much warming could alter earth's weather and cause the polar caps to melt resulting in flooding of coastal cities.

Because our reserves of fossil fuels are dwindling, scientists are exploring other energy sources. Energy sources of the future must be more plentiful, and less harmful to the environment. Scientists are exploring these new forms of energy to generate electricity:

- Solar energy -using the sun
- Wind energy -using wind to turn a windmill
- Nuclear energy -splitting uranium atoms to create heat energy
- Geothermal energy -harnessing heat and steam generated below Earth's surface
- Waves and Tides -using the force of ocean waves and tides
- Biomass -producing fuels from living materials or decayed waste materials

HOW MANY WAYS ARE THERE TO SAVE ENERGY?

Energy saved is energy gained for another day! Saving energy will cut down on pollution and help our fossil fuels last longer, at least, until the renewable energy resources become more practical. Here are some energy saving tips that students should know:

- Turn off the radio and television when not in use.
- Turn off the lights when you are not using them.
- Use a solar powered calculator instead of a battery powdered calculator.
- Ride the bus to the Rockies or Broncos game instead to taking the car.
- Don't leave the refrigerator door open for a long time.
- Don't use an electric toothbrush.
- Use a hand operated can opener, not an electric one.
- Use a sweater to stay warm in the winter instead of turning up the thermostat.
- Recycle your pop cans, glass bottles and plastic containers.
- Use a fluorescent bulb instead of an incandescent one.
- Pass the clothes you've outgrown to a brother or sister or to someone who needs them.

Energy Classification

Activity 1: Sunbeams

Activity 2: Energy Collage

Activity 3: Where Does It Get Its Energy?

Task Assessment #1

Activity 1 **SUNBEAMS**

CONCEPT The primary source of energy is the sun.

BACKGROUND

WHAT IS ENERGY?

- Energy gives us the ability to do things such as climb a mountain, play soccer, and even think. This energy is stored in our muscles and brain cells.
- There are other types of energy such as that used to light a street lamp, heat or cool our homes, cook our food, and power buses, planes and cars.
- You cannot hold energy in your hand because, unlike matter, it has no shape. Matter, like footballs and snowflakes, has shape; energy does not. However, energy can take many forms. Heat waves, electricity, TV waves, dental X-rays, and sunbeams are all different forms of energy.
- One form of energy can be changed into another form. When gasoline is burned in a school bus engine, the energy contained in gasoline is changed into heat energy. When we stand in the sun, light energy is changed into heat. When you turn on a flashlight, chemical energy stored in the battery is changed into light and heat.
- Energy is used to do work. We use energy when we climb a mountain with a backpack or we use energy when we eat food and notice that we grow (either upward or outward). We can play tennis for periods of time, and we can think about the story line in a good novel.
- Energy causes movement. Every time you see something move, energy is being used. A leaf moving in the wind, a pot of boiling water, and a school bus traveling to school are all evidence of energy being used. You know that energy exists because you can see or feel what it does. Energy moves cars, makes machines run, heats ovens, and lights our classrooms.
- In summary, *to find energy, look for motion, heat, light, sound, chemical reactions, or electricity!*

WHERE DOES ALL ENERGY COME FROM?

The sun is the source of all energy. The sun's energy is stored in coal, petroleum, natural gas, food, water and wind.

WHAT ARE THE MOST COMMON ENERGY SOURCES?

Most of the energy we use comes from burning one of the fuels – coal, petroleum or oil, or natural gas. These are called fossil fuels and are *nonrenewable energy sources* because, when used, they are gone. Fossil fuels come from remains of plants and animals as they were slowly covered and crushed by layers of rock, mud, sand, and water. Over a long period of time, the pressure of all those layers caused the plants and animals to break down into fossil fuels. These fuels typically contain the elements carbon and hydrogen.

Scientists are now exploring the practicality of other energy sources, which are called *renewable energy sources.* These include the sun, wind, ocean currents, biomass, and certain atomic nuclei. Scientists at the National Renewable Energy Laboratory (NREL) are exploring some of these research areas.

Today, nonrenewable energy sources supply the majority of our energy needs because we have designed ways to transform their energy on a large scale to meet consumer needs. Regardless of the energy source, the energy contained in them is changed into a more useful form – *electricity.*

GOAL Students will identify ways in which the sun's energy comes to them.

MATERIALS (per student):

Item	Amount	Where to find it
Card Stock (yellow)	1 sheet /sun & 1 per sunbeams	Discount (K-Mart, Wal-Mart, Target, or similar)
Circle Cutout Pattern	1-per class	***Included in activity
Glue	1 Teacher use	Discount
Markers	Students to share	Discount
Punch (1-hole)	1-per class	Discount
Scissors	1-Teacher use	Discount
String or Yarn	Enough to hang suns up	Discount
Sunbeams Cutout Pattern	1-per class	***Included in activity

NOTE: You may need to cut out sunbeams and suns ahead of time.

STRATEGIES

INVITE

1. Begin this activity with a high-energy introduction such as a song or dance. For example, "Johnny Works with One Hammer" or the Bunny Hop are good introductions that show children how they use up energy.

EXPLORE. DISCOVER

2. Write or draw a picture of the sun on the board. Write the word "Energy" in it and ask: What kinds of energy do we get from the sun?

3. Write their responses on the board. It's important to accept all reasonable examples of energy .The idea is for children to see that the sun is the primary source for a lot of different things (i.e., food, wood, coal, oil, gas, light, plants, trees, heat, wind.) You may need to explain some of the less obvious connections between their energy example and the sun.

CREATE

4. Cut out the sun circle on card stock. Write the word "Energy" on the sun.
You can also have students design their own suns.

5. Cut out 7-8 "sunbeams" from the second sheet of cardstock.

6. Write an energy word (from the board) on separate beams with a marker.

7. Glue the beams to the circle.

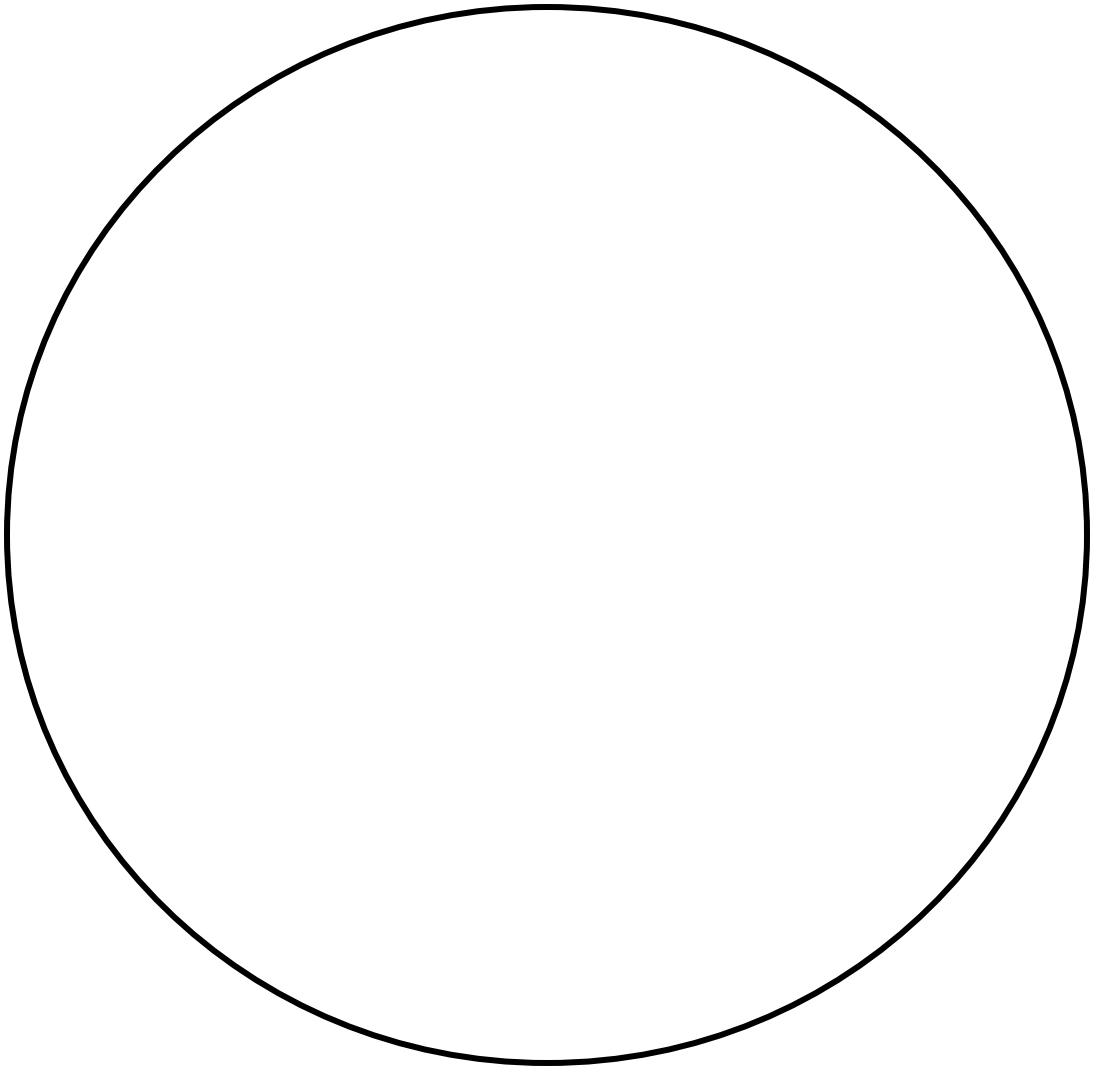
8. Punch a tiny hole in the sun, insert a piece of string, and hang it from the ceiling or attach the sun to a bulletin board.

EXPLAIN AND TAKE ACTION

9. Have students share their "mobile" with others in the class. Look for unique or common examples of energy from the sun.

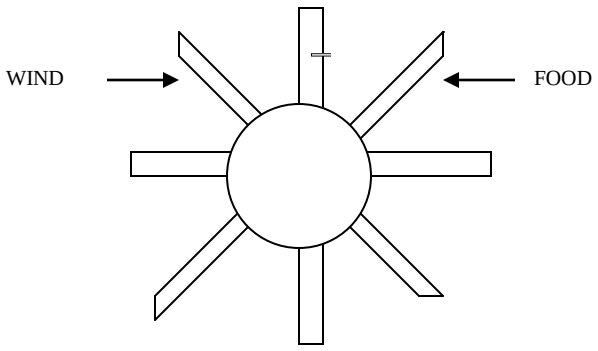
10. Ask children how their energy examples would be different if we had no sun or two suns or a sun that was closer or farther away.

CIRCLE CUT-OUT



SUN BEAMS CUT-OUT

	glue
	glue
	glue
	glue
	glue
	glue
	glue
	glue



Activity 1 **ENERGY COLLAGE**

CONCEPT Energy can be classified in many different ways.

BACKGROUND

FORMS AND SOURCES OF ENERGY

There are seven **forms** of energy. Just remember the name: MRS CHEN.

M Mechanical energy (kinetic energy); its counterpart is stored energy (potential energy)
R Radiant energy or sunlight or solar
S Sound energy
C Chemical energy
H Heat energy
E Electrical energy
N Nuclear energy

The **First Law of Thermodynamics** states that energy cannot be created or destroyed; it only changes form. **Sources of energy, then, are materials or objects that produce energy by changing it from one form to another.**

ENERGY SOURCE	CHANGES FROM THIS FORM…	TO THIS FORM
Solar Cell	Radiant	Electrical
Wind	Mechanical (kinetic—blades turning)	Electrical, Mechanical
Battery	Chemical (i.e. alkali battery	Electrical
Space Heater	Electrical (outlet)	Heat, Mechanical (fan)
Gasoline	Chemical (combustion)	Mechanical, Heat, Sound
Oil, Coal, Nat'l Gas	Chemical (combustion)	Heat, Mechanical, Electrical
Food	Chemical (digestion)	Mechanical (muscles), Heat, Sound
Wood	Chemical (combustion)	Heat, Radiant, Sound

You can see that combustion (or burning) of an energy source gives us other forms of energy that our society uses every day. This is primarily why global warming has become an environmental problem in the last century. Combustion releases carbon dioxide, which, in turn, traps heat in the lower atmosphere. Renewable energies such as solar cells and wind do not rely on combustion to produce the energy we use.

Oil, coal and natural gas are called *fossil fuels* because they come from plants and animals that have been buried for millions of years. The weight from mud and rock created pressure and heat that changed the plants and animals into fossil fuels. These energy sources are considered **nonrenewable** because once they are consumed, they are gone. It would take millions of years to produce more oil, gas, and coal.

Solar cells, wind turbines, biomass (plant material used to produce fuels), solar-thermal (sources that convert radiant to heat energy) are energy sources that can be reused because their primary source is the sun. Because the sun has an expected life span of 5 billion more years, these energies are considered **renewable.** NOTE: Wind is no a *form* of energy so it's not found in MRS CHEN. Wind is a *source* of mechanical or motion energy.

Since the sun has provided radiant light and heat to all living and nonliving things on the planet, it can be thought of as the primary source of both renewable and nonrenewable energies.

GOAL Students will create an energy collage that classifies different kinds of energy.

MATERIALS (per student):

Item	Amount	Where to find it
Energy Classification, Transparency Master	1 – per class	***Included in activity
Glue Sticks	Students can share	Discount
Magazines	At least 1per student	Have students bring
Markers (from activity 1)	Students can share	Discount
MRS CHEN Poster	1-per class	Teacher made
Paper (Butcher)	Alternate to construction paper	Paper supply store
Paper (construction)	1-per group of 3 or 4	Discount
Scissors	1-per student	Discount

STRATEGIES

INVITE

1. Review the different kinds of energy that come from the sun using the students' "Sunbeams."

2. There are many new terms introduced in this activity--energy , form, source, renewable and nonrenewable. Remember to encourage the use of new vocabulary throughout these activities.

EXPLORE. DISCOVER

3. Show students the poster of MRS CHEN. Explain that these are *forms of energy.*

4. Tell students that these forms of energy can change from one to another. Illustrate this by having students rub their hands together really fast. Point to the "M" in MRS CHEN. This "M" stands for mechanical or motion energy. Ask them what they feel when they rub their hands together fast (heat). Point to the "H" in MRS CHEN .

If you are near a window on a sunny day, have some students stand in the sunlight. Point to "R" and explain that sunlight is radiant energy. Ask students what they observe by standing in the sun (they feel warmth, heat). Point to "H" again. (Not all energy changes are this easy!)

5. Now ask students to name something from outside, at home, in school that would make "heat" (fireplace, stove, heat lamp, furnace, etc.). Ask, what makes "light?" (sun, fire, flashlight, bulbs, etc.). Make a list of their examples on the board. Tell them they are all examples of energy *sources.* (Sources of energy are really just objects that convert energy from one form to another--fires are chemical reactions from burning wood that change into light and heat--"C" into "R" and "H".)

6. Introduce students to these two new terms: *renewable.* and *nonrenewable* energy. Write them on the board. Provide this example: A student goes to the library and checks out a book. If he/she doesn't finish it in time, the book is taken back to the library to renew it. Renewable energy can be used over and over--it's recyclable. Nonrenewable energy takes millions of years to form and, once it's used, it's gone. (Coal, oil and gas were formed during the age of dinosaurs. We'd have to wait 65 million years to replace these energy sources!)

If you wish to challenge e our students further, 7. Otherwise, proceed to "CREATE."

7 .Use the overhead transparency and have students put the examples from the board into the correct box.

	SOURCE
RENEWABLE	sun, wind, fire, food, trees, water
NONRENEW ABLE	coal, oil, gasoline, natural gas, candles, furnace, cars, most electrical appliances since they rely on coal-burning power plants

CREATE

8. Have students cut out pictures from magazines which illustrate the examples of energy. Encourage them to look for some unusual examples.

9. Give each student a piece of construction paper and a marker. Have students work in small groups to share ideas.

10. Have students create their own classification system using their cut-out pictures glued onto construction paper. Students can classify pictures by form, source, renewable, nonrenewable, electrical, heat, light, mechanical, sound, etc. Use markers to make connections, add vocabulary, organize the collage, etc.

OR

Students could make a class collage by cutting out pictures and gluing them on large papers that are labeled and taped to a chalkboard.

EXPLAIN AND TAKE ACTION

11. Have students present their finished collages to the class and explain how they classified their pictures.

ENERGY CLASSIFICATION

(For Energy Collage—Activity 2)

	ENERGY SOURCE
RENEWABLE ENERGY	
NONRENEWABLE ENRGY	

Activity 3 **WHERE DOES IT GET ITS ENERGY?**

CONCEPT All living things and natural processes require energy.

GOAL Students will match energy words to energy pictures and create a booklet of energy uses. *(This activity may be best suited for second graders. Younger students can do this activity with the teacher using transparencies of the energy pictures/words on an overhead projector. Modify strategies according to your needs.)*

MATERIALS (per student--second grade):

Item	Amount	Where to find it
Energy use pictures	1-set per student	***Included in activity
Energy cards	1-set per student	***Included in activity
Glue Stick (from Activity 2)	Students can share	Discount
Paper (construction) strip "41/4 X 8" inches	1-per student Cover of energy book	Discount
Scissors (from activity 2)	1-per student	Discount
Stapler	1-per class (Teacher use)	Discount

MATERIALS (for the class K -I) Overhead projector, pens**,** transparencies.

STRATEGIES

INVITE

1. Write the following energy words on the board: *gasoline, sun, wood, wind, food, and electricity.* Go over each word with the students. Ask them to suggest ways that the energy can be used.

EXPLORE. DISCOVER

2. Hand out one set of energy pictures and energy words to each student. Cut pictures and words apart.
3. Have students lay the energy pictures and words on the desk. Have them look at one energy picture. Ask them "Where Does It Get Its Energy?"
4. Students should choose one of the eight cut-out words and glue it in the blank space at the bottom of the picture. Have them share their answers on this first example.
5. Let students finish the other seven pictures on their own.

CREATE

6. Hand out construction paper strips 4 114" X 8 " while students are coloring their energy pictures.
7. When students complete the coloring, have them sort their pictures according to their own classification system to create a booklet.

Challenge students to sort their pictures according to whether the energy word is renewable or nonrenewable.

ANSWER KEY

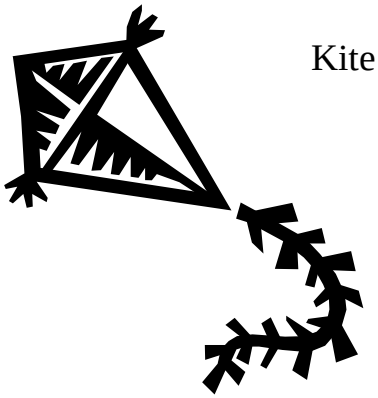
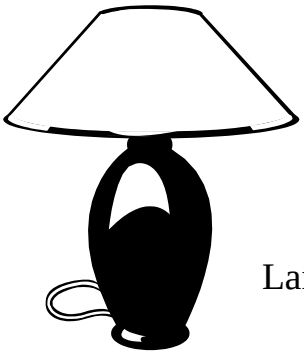
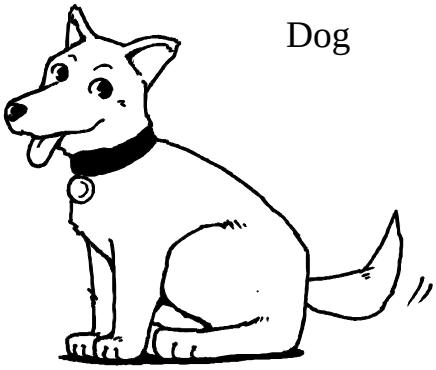
ENERGY TYPE	PICTURE NAME
RENEWABLE	kite (wind), dog (food), tree (sun), fire (wood), sailboat (wind)
NONRENEWABLE	lamp (electricity), car (gasoline), television (electricity)

8. Have students use the construction paper strip as a cover for their "Energy Use Booklet." Fold the construction paper in half so that it creates a front and a back for the booklet. Students will need to include a title and their name on the cover. Staple the booklet together or you can use yarn as a binder.

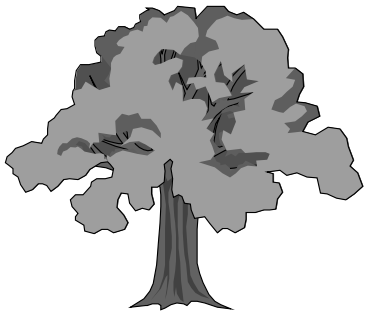
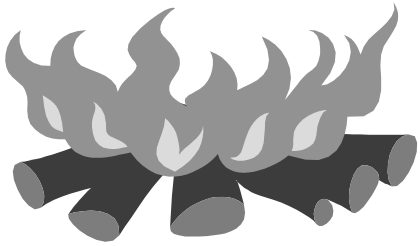
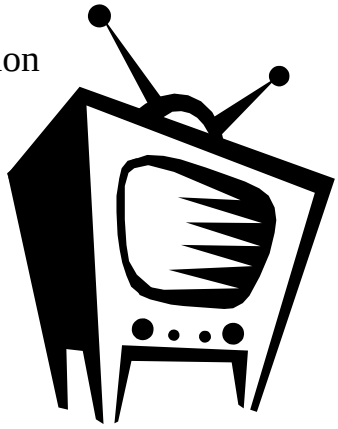
EXPLAIN AND TAKE ACTION

9. Let students read or explain their booklet classification to another student or to you. Be sure they explain where the item in the picture gets its energy.
10. Ask students if there are other places where the item could get its energy. (For example, a sailboat uses mechanical energy when a person rows the boat; a car can get energy from electricity and the sun, etc.)

WHERE DOES IT GET ITS ENERGY?

Kite 	 Lamp
Car 	Dog 

WHERE DOES IT GET ITS ENERGY?

Tree 	Fire 
Television 	Sailboat 

WHERE DOES IT GET ITS ENERGY?

Directions: Cut out the energy words and paste them below the pictures they match.

Gasoline	Sun
Wind	Electricity
Wind	Food
Electricity	Wood

Task Assessment #1: **ENERGY CLASSIFICATION**

CONCEPT There are many different kinds of energy.

GOAL Students will match pictures of energy sources with energy words.

MATERIALS (per student): Crayons, colored pencils, 1 copy of "Energy Classification," Assessment Rubric.

STRATEGIES

INVITE

I. Review with students the different kinds of energy. Be sure they see a distinction between forms, sources, renewable and nonrenewable energy.

2. Share with students the rubric by which they will be evaluated.

EXPLORE. DISCOVER

3. Give each student a copy of "Energy Classification." Ask them to identify the word on the sheet with its matching energy picture.

CREATE

4. Color the pictures of those energy sources they have used today.

EXPLAIN AND TAKE ACTION

5. Have students put a circle around the picture that represents RENEW ABLE ENERGY. (There are five pictures: B, C, E, F, and H. Picture I could be renewable if the electricity comes from solar-powered cells or wind turbines.)

OR

6. Have students put a circle around the pictures that represent something from MRS CHEN. (There are two forms of energy: C (radiant) and I (electricity).

OR

7. Have students circle the energy sources that produce heat, light, and/or electricity.

OR

8. Have students do ALL OF THE ABOVE using colored pencils and a color key:

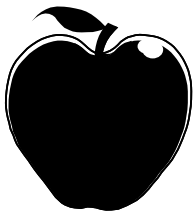
blue circles for renewable energy (#4)
black circles for energy forms from MRS CHEN (#5)
red circles for examples of energy sources that produce heat (#6)
yellow circles for examples of energy sources that produce light (#6)
green circles for example of energy sources that produce electricity (#6)

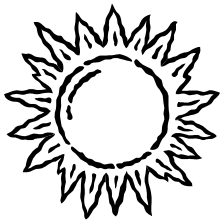
NAME: _____

Task Assessment #1: **ENERGY CLASSIFICATION**

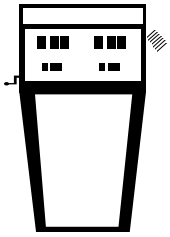
Directions: Choose a word from the list below and copy it under the picture that it matches.

Word List: **WOOD** **FOOD** **COAL** **OIL** **WATER**
SUN (RADIANT) **GASOLINE** **WIND** **ELECTRICITY**

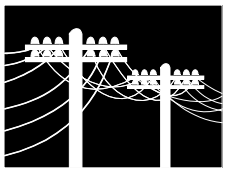




A._____ B._____ C.._____



A._____ B._____ C._____



A._____ B._____ C._____

Rubric for Task Assessments

Fun With the Sun
Activities for Elementary Grades K-2

General Scale for Scoring Student Performance

SCORE	DESCRIPTION
5	Beyond expectations—quality of work is unusually high and beyond expectations
4	Meets expectation—skill is mastered to the level of expectation
3	Almost there—skill is almost mastered but with minor problems
2	The skill is present but with errors and omissions
1	The skill is absent

Energy
Uses/Limits

Activity 4: Do Electrical Appliances Save Time?

Activity 5: Safety with Electricity

Task Assessment #2

Activity 4 **DO ELECTRICAL APPLIANCES SAVE TIME?**

CONCEPT Using energy helps make our lives more convenient.

GOAL Students will recognize how people use energy to do work that was once done by hand.
MATERIALS: You 'll need volunteer or parent supervisors for this activity. 2 electric mixers, marking pens, four bowls, 4 pudding packages, 8 cups milk (made from powdered), 30 paper cups, 30 plastic spoons, 1 wooden spoon, 30 copies of Experiment Sheet, Experiment Chart (for K-l). (For demonstration purposes: bar of soap, electric knife, paring knife, can opener, electric can opener, can of pineapple.)

STRATEGIES

INVITE

1. Explain to students the amount of energy it takes to do things, e.g., brush teeth with or without an electric tooth brush, walk or bike to school, burn a wood fire to keep warm in the winter, etc. Some of these activities take a long time, but some are good exercise. Then show students an electric knife, electric toothbrush, or electric can opener and explain that we have these things because of their convenience (they help us save time). You can demonstrate this by cutting a bar of soap with a hand knife followed by cutting with an electric knife or open the end of a can with a hand can opener and an electric can opener. Conclude that electricity is a convenient form of energy and provides a better standard of living. In a subsequent activity you will discuss how we should not waste energy (electricity).

2. Put the following on the board: **THEN NOW**

3. Ask students to add examples of the ways we use energy now, and how it was done in the past. For example:

THEN	**NOW**
Spoon	Electric Mixer
Legs, horse	Car, motorcycle
Paper, pencil	Computers (Note: Even thought computers use electricity, they may save paper with the use of e-mail, monitors, etc.)

EXPLOR. DISCOVER

NOTE: For K -1, the teacher should use the Experiment Chart and fill in the information as a class discussion. Students can also copy your sentences for extra practice. Get ideas from students and model the scientific process. Use the strategies below as a guide.

4. Tell students that they will participate in an experiment. Hand out "Experiment" page to each student. (K-l teachers can skip handing out papers.) Have students fill in name and date. Tell them an experiment is a way of finding the answer to a question by writing down what is observed. They can then try to explain what they observed. Many times, writing a conclusion means coming up with more questions, which lead to more predictions, which lead to more experiments. Most experiments produce more questions than answers!

5. Divide the class in half. One half will be "Green" and the other half will be "Red." (You can choose different ways to name the groups: renewable, nonrenewable, "then", "now", etc.) Divide these two groups in half again--A's and E's. You will end up with Green A, Green E, Red A and Red E groups. Tell the students they will perform a task that uses energy "then" and "now." Tell them they will be making chocolate pudding two different ways: "then" using a spoon; and "now" using an electric mixer.

6. Ask: "Which method will take longer?" Have students fill in their prediction on the "Experiment" sheet. The teacher can assist on each "Experiment" sheet by writing under the student's writing. (Or, K-l, the teacher fills this information in on the chart using ideas from the class.)

OR You can have two sets of classroom "Experiment" papers. On one write "Mixer" and on the other write "Spoon." Have students put their names on the paper that matches their prediction.

CREATE

7. Assign a bowl containing 2 cups of cold milk and 1 package of unopened pudding mix to each group. Hand out an electric mixer to a parent volunteer in Green A and Red A. Hand out a wooden spoon to Green B and Red B. Be sure the "Greens" work near each other and the "Reds" work near each other.

8. Tell each group to add one package of pudding to each bowl--CAREFULLY!

9. Tell each group to mix the pudding powder and milk together. Caution them not to let any spill out. Ask students to observe how long it takes to mix the pudding and how easy or difficult it is.

After the pudding is mixed, have each group put the bowls in a cool place for a few minutes (to set). Meanwhile. .

10. Have students write down what they did (procedure). (K-l teachers should let students summarize the steps while you write it on the "Experiment" chart.)

EXPLAIN AND TAKE ACTION

11. Have students write down what they observed (using four senses: see, hear, smell, touch). It's never a good idea to taste anything unless the teacher says it's OK! (Again, K-l teachers summarize the class' observations and put this on the "Experiment" chart.)

12. Serve up the pudding into paper cups while students discuss which saved time in getting the ingredients to mix the best. Have students write a conclusion that explains what they observed. How did their prediction and conclusion compare? **(Take time to do this important step. Students need to see that being "wrong" on their prediction is OK and that doing experiments means asking more questions.)** (K-l teachers need to write a class conclusion.)

13. Discuss the advantages and disadvantages of both procedures. Do the two puddings taste differently? Ask students if a parent makes gravy by one of these methods or perhaps uses another (e.g., shakes a water-flour mixture in a capped jar).

NAME_____

Today's Date_____

_____**Experiment**

1. What do I think will happen? (prediction)

_____

_____

_____

_____

2. What I did: (procedure)

_____

_____

_____

_____

3. What I saw: (observation)

_____

_____

_____

4. What I think: (conclusion)

_____

_____

5. Compare your prediction and conclusion:

_____

_____

_____

_____

Activity 5 **SAFETY WITH ELECTRICITY**

CONCEPT There are certain risks in using energy forms like electricity.

GOAL Students will create an electrical safety book.

MATERIALS (per student):

Item	Amount	Where to find it
Cardstock for Safety Drawings	Depending on number of sets	Discount
Crayons	Students can share	Discount
Lighting Safety Tips Chart Master	1-per class	***Included in activity
Paper (construction)(from activity 3)	1-per student	Discount
Punch (1-hole)(from activity 1)	1-per class	Discount
Safety Drawings (set of 6) Master	1-per student or group	***Included in activity
Scissors (from activity 2)	1-per student	Discount
Yarn or string (from activity 1)	Book binding 1-per student	Discount

STRATEGIES

INVITE

1. Review with students how electrical appliances make our lives more convenient.

2. Ask students if they have ever seen lightning. Ask what form of energy lightning is. (Electrical)

2. Have students share what they know about safety precautions for lightning. (See attached safety list.)

EXPLORE. DISCOVER

4. Direct the discussion back to the electric mixer from the previous activity .Ask how many of their safety precautions should they take when using an electric appliance. (One humorous example: a safety precaution for lightning is to squat down on your heels without any other part of your body touching the ground. Your head and shoulders should be lowered as much as possible. Would this be a practical safety rule for when a student's mom or dad uses an electric mixer?)

5. Go through the safety cards (6 of them) and read the captions aloud. You may want to hold off using the cards and presenting situations to them to see if they can come up with the common sense rules. For example, before showing them the picture, ask what safety rules they should remember when flying a kite.

CREATE

6. Have students color the pictures. (You may want to save time and have them work on one book in groups of two or three)

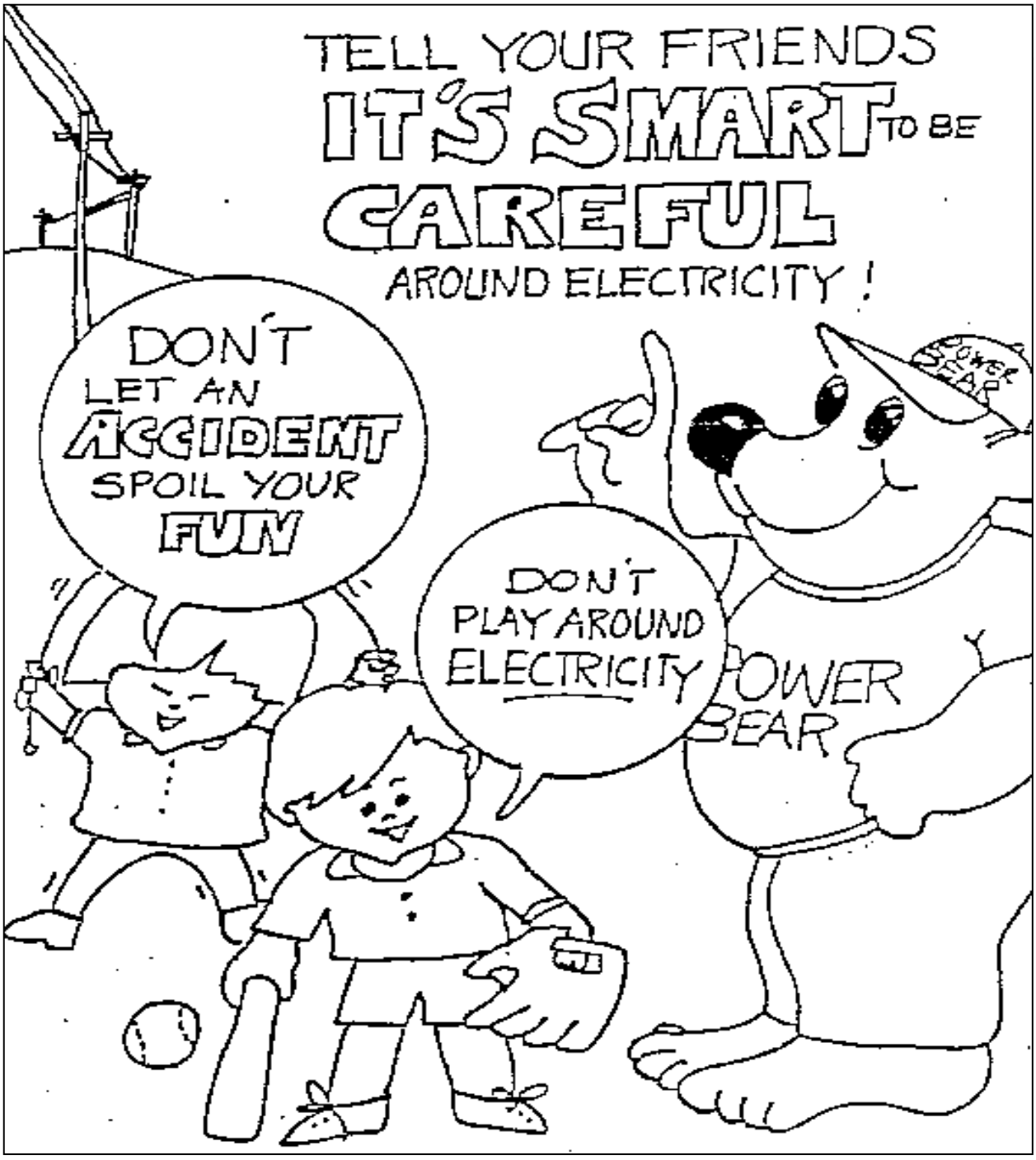
7. When the pictures are completed, have students sort them, fold a piece of construction paper so that it creates a front/back cover, then punch two holes for a yarn binder.

8. Give students I-foot piece of yarn to thread through the punched holes. Tie a knot. Be sure they put their names and give the book a creative title. Have them illustrate the cover with some or all the sources of electricity that they can think of.

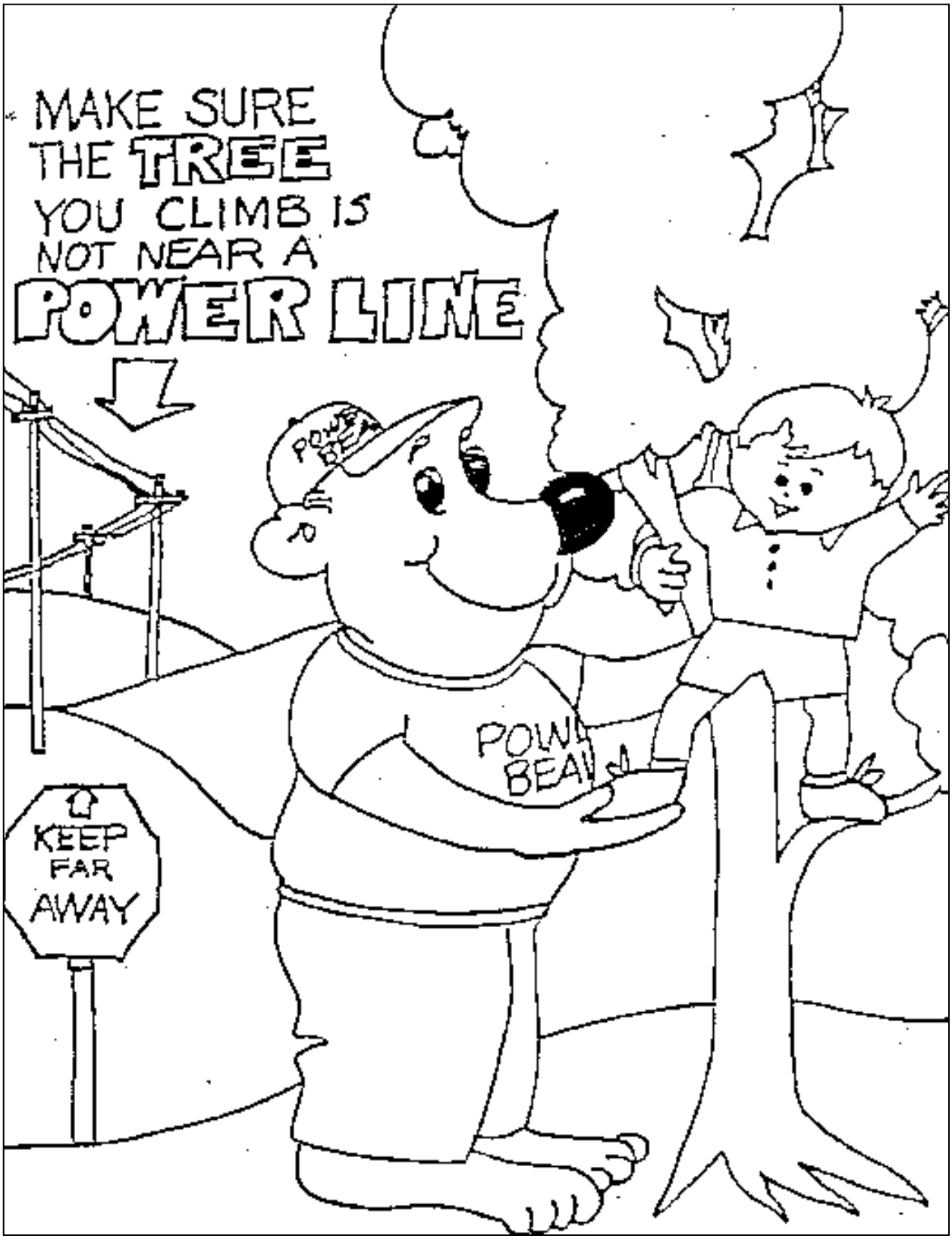
EXPLAIN AND TAKE ACTION

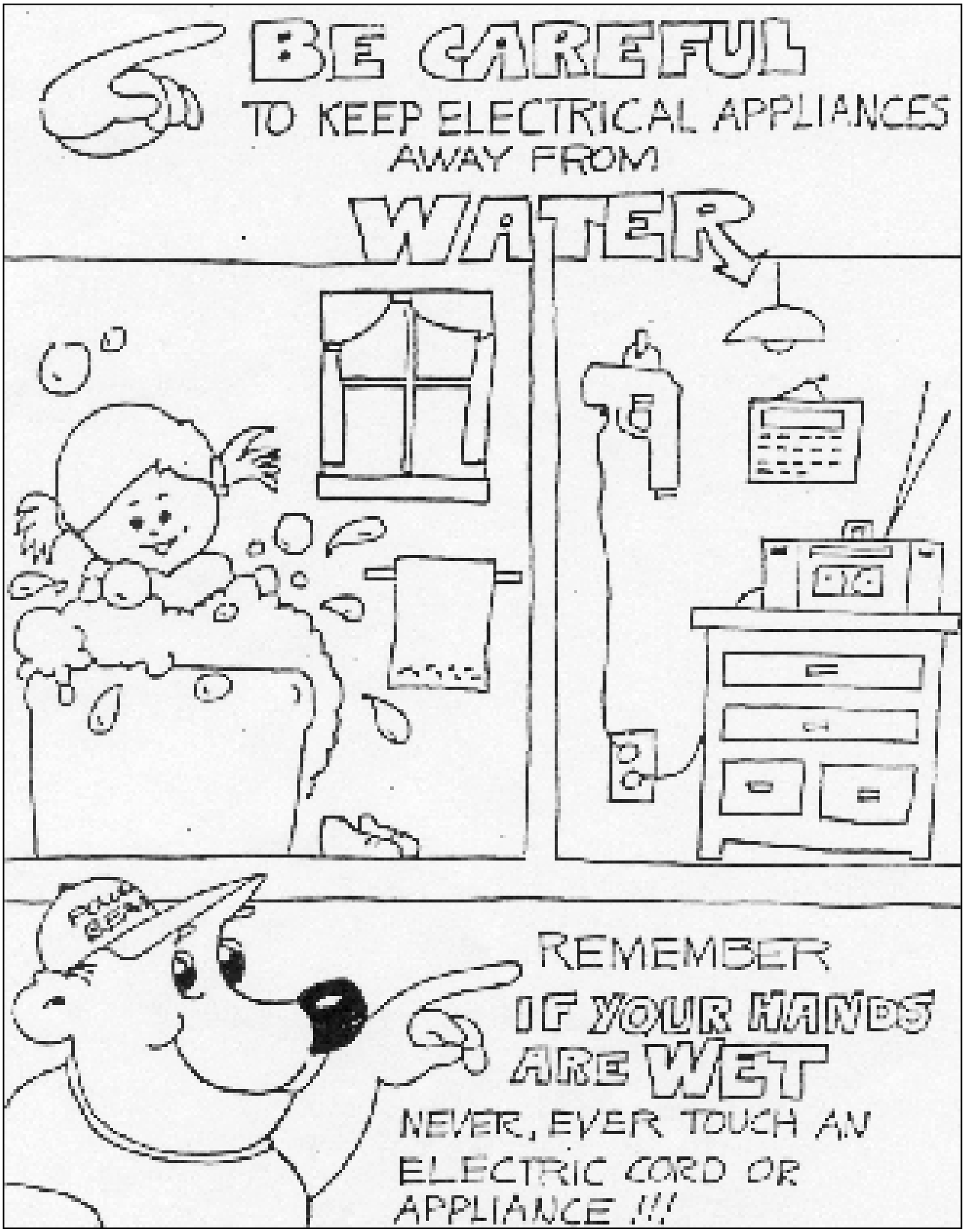
9. Have students take the book home to show to their parents. Ask them to explain that electricity is a form of energy that is useful but also dangerous.

NOTE TO TEACHERS: You can contact Xcel energy 1-800-895-4999 or your local energy supplier regarding their classroom materials on electrical and natural gas safety.

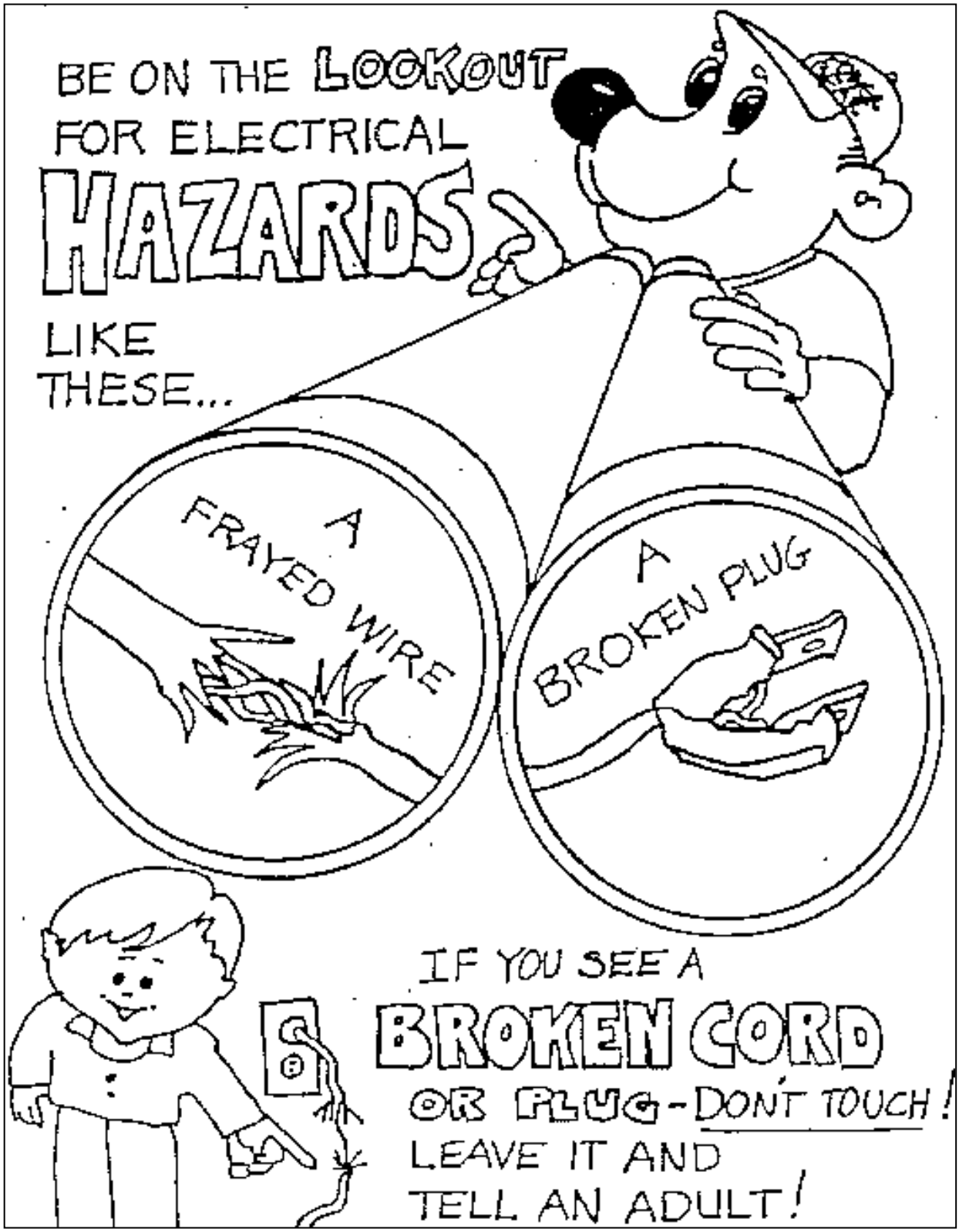

TELL YOUR FRIENDS
IT'S SMART TO BE
CAREFUL
AROUND ELECTRICITY !
DON'T LET AN ACCIDENT SPOIL YOUR FUN
DON'T PLAY AROUND ELECTRICITY
POWER BEAR
POWER BEAR


LOOK UP
BEFORE FLYING A KITE.
PLAY SAFELY
AWAY FROM
POWER
LINES.
POW
BE
IF YOUR KITE GETS NEAR A POWER LINE, LET GO! HAVE AN ADULT CALL THE POWER COMPANY IF IT GETS CAUGHT IN THE WIRES. DONT TOUCH THE STRING.


MAKE SURE THE TREE YOU CLIMB IS NOT NEAR A POWER LINE
KEEP FAR AWAY


BE CAREFUL
TO KEEP ELECTRICAL APPLIANCES
AWAY FROM
WATER
REMEMBER
IF YOUR HANDS
ARE WET
NEVER, EVER TOUCH AN
ELECTRIC CORD OR
APPLIANCE !!!


DON'T PLAY
NEAR POWER
COMPANY EQUIPMENT
SUBSTATION
NO!
STAY
AWAY!
TRANSFORMER
BOX


BE ON THE LOOKOUT
FOR ELECTRICAL
HAZARDS
LIKE
THESE...
A
FRAYED WIRE
A
BROKEN PLUG
IF YOU SEE A
BROKEN CORD
OR PLUG - DON'T TOUCH!
LEAVE IT AND
TELL AN ADULT!

ACTIVITY 5: SAFETY WITH ELECTRICITY

LIGHTNING SAFETY TIPS

1. **Keep an eye on the sky. Look for darkening clouds.**

2. **Listen for thunder. Count** 5 **seconds per mile from when you see lightning to when you hear thunder. (If you count** 5 **seconds, the lightning is** I **mile away; 10 seconds, the lightning is** 2 **miles away; and so on.)**

3. **When** a **storm approaches, go inside** a **building. Stay away from windows, pipes, and electrical outlets.**

4. **Unplug appliances and avoid using the telephone. Don't take** a **shower or bath.**

5. **If you are not near a building, go inside a car, truck or bus with a metal roof but don't touch the metal.**

6. **If you are outside, assign someone the responsibility to track lightning. If lightning is nearby, seek shelter under shorter trees or in low lying areas. Stay away from tall trees, single trees, poles, fences, etc. (Watch out for flooding.)**

7. **If you are boating or swimming, go to shore and seek shelter immediately.**

8. **Be a very small target!**

9. **Stay in** a **safe place until the threat of lightning is over**.

10. **Be aware of your surroundings.**

Task Assessment #2: **ENERGY USES/LIMITS**

CONCEPT Energy can change forms in ways that are useful to people. However, there are limits to the energy we use as well as to its safety.

GOAL Students will create a poster illustrating an energy-using device, its purpose, and safety rules to follow when using it.

MATERIALS Butcher paper (about 2' X 3' piece per student), crayons, markers, Experiment Chart, and Assessment Rubric. (Students also can bring materials from home to build an "appliance.")

STRATEGIES

INVITE

1. Ask students: What appliances save us time by: Washing dishes? Washing clothes? Getting us to the store? Helping us see to read? Then ask: What are some safety rules to remember when using these appliances?

2. Be sure students see that using energy can save us time but that there are safety rules to remember.

3. Using the Experiment Chart, take students through the steps of the scientific process. They'll need to think of these steps as they set out to solve the scientific problem described below.

EXPLORE. DISCOVER

4. Divide students into groups of 4. Hand out pieces of butcher paper. Students can use markers.

5. Present students with a problem: (choose one of these or make up one of your own)

- **design an imaginary time-saving appliance that can do the dishes, dry and put them away
- **design an imaginary time-saving appliance that can do your homework
- **design an imaginary time-saving appliance that can make your bed
- **design an imaginary time-saving appliance that can play second base, quarterback, soccer goalie or tennis, etc.
- **design an imaginary time-saving appliance that can transport you anywhere

The only rule is that this imaginary time-saving appliance must use some kind of energy. (Choose one or more from MRS CHEN or choose any of the sources that were discussed in earlier activities. Encourage students to use renewable energy sources, i.e., rechargeable batteries, solar cells, water generators, etc.)

6. Include at least 3 safety rules to follow when using this imaginary appliance.

7. Hand out and review the rubric with students.

CREATE

8. Each student's picture must fill up the available space and should include the name for their appliance, the type of energy that is used, what the appliance does, how it saves time, and at least 3 safety rules.

EXPLAIN AND TAKE ACTION

9. Have students show their posters to the rest of the class and explain: what the appliance is, how it saves time, the kind of energy it uses, and safety rules to follow.

NAME_____

Today's Date_____

_____**Experiment**

3. What do I think will happen? (prediction)

_____

_____

_____

_____

2. What I did: (procedure)

_____

_____

_____

_____

3. What I saw: (observation)

_____

_____

_____

4. What I think: (conclusion)

_____

_____

5. Compare your prediction and conclusion:

_____

_____

_____

_____

Rubric for Task Assessments

Fun With the Sun
Activities for Elementary Grades K-2

General Scale for Scoring Student Performance

SCORE	DESCRIPTION
5	Beyond expectations—quality of work is unusually high and beyond expectations
4	Meets expectation—skill is mastered to the level of expectation
3	Almost there—skill is almost mastered but with minor problems
2	The skill is present but with errors and omissions
1	The skill is absent

Energy Conversion

Activity 6: A Bright Idea

Task Assessment #3

Activity 6 **A BRIGHT IDEA** (THIS ACTIVITY SHOULD BE STARTED AT THE BEGINNING OF THE DAY.)

CONCEPT Energy occurs in many forms and one energy form can be changed into another energy form.

GOAL Students will understand how one form of energy can be changed into another form.

MATERIALS (per student):

Item	Amount	Where to find it
Candles	4 (large, in holders)	Discount
Experiment sheet Master	1-per student	***Included in activity
Flashlight (small, pen light w/ battery)	1-per class	Discount
Matches (to light candles)	1- Teacher demo	Teacher
Toy (battery operated) OPTIONAL	varies	Student

.

STRATEGIES

INVITE

I. Remind students that energy can be changed from one form to another. Ask students whether a candle is *a form* of energy or a *source.* (Is the word 'candle' in MRS CHEN? No. Therefore, a candle (wax) is a source of energy.) Hold up a battery and ask whether it is a form or a source. (Source)

EXPLORE. DISCOVER

2. Ask students what forms of energy they might get from a battery (heat, light, mechanical (motion), sound, electricity). Ask what forms might come from a candle (heat and light).

3. Ask students to predict which will last longer: a burning candle or a flashlight left on. (You can substitute a battery-operated toy.) Have students complete #1 on the Experiment Sheet.

CREATE

4. Take the flashlight (toy) apart and show students the battery inside. Tell them it is a fresh battery. Put it back together and turn it on so that the beam faces a wall and the light can be easily seen.

5. Next, tell them you are going to strike a match (which is an example of chemical energy), and light the candle(s). This demonstration should be done by the teacher. You can light al14 candles so that students can make observations in smaller groups, but keep the candles in a circle so you can supervise there actions.

6. Have students carefully bring hands near the flame without touching it. Point out that the wax is the source of the energy. Ask whether wax is renewable or nonrenewable? (Will the wax last forever? No, it's nonrenewable.) There are many observations that can be made of a candle. Ask students to share what they observe. Have students do the same thing with the flashlight (toy) by observing the different forms of energy.

7. Leave the candle(s) and flashlight (toy) in an area where they won't be disturbed while you have students complete #2 on the Experiment Sheet. Move onto another activity and come back to the experiment periodically throughout the day.

EXPLAIN AND TAKE ACTION

8. At the end of the day, you will probably observe that the candle burned out before the flashlight. Ask students why. Remember to encourage the use of vocabulary terms such as source (wax, battery), fuel (wax, chemicals in the battery), renewable (rechargeable batteries), nonrenewable (wax, regular batteries).

9. Have students complete #3, #4, and #5 on their Experiment Sheet.

10. Ask them how they could keep the energy source (battery or wax) from running out so fast. (Students may come up with unique ways to make a battery or candle last longer while still running the flashlight or burning the candle. However, encourage them to see that when the energy source is not needed, it can be turned off (or blown out) and used for another time. This is the easiest way to save energy since energy is stored in the battery and wax.)

11. Look around the room and identify things that are using energy that could be turned off -- overhead projector? Some of the room lights? Flashlight? Ask students to look around at home for things that can be turned off and saved for another time.

NAME_____

Today's Date_____

_____**Experiment**

4. What do I think will happen? (prediction)

_____

_____

_____

_____

2. What I did: (procedure)

_____

_____

_____

_____

3. What I saw: (observation)

_____

_____

_____

4. What I think: (conclusion)

_____

_____

5. Compare your prediction and conclusion:

_____

_____

_____

_____

Task Assessment #3 **ENERGY CONVERSION**

CONCEPT Energy occurs in many forms and one energy form can be changed into another energy form.

GOAL Students will complete a chart of energy conversion examples.

MATERIALS (For the teacher only: matches), battery powered toys brought from home, pencil, "Ab Ra Ca Dab Ra" worksheet, Assessment Rubric.

STRATEGIES

INVITE

1. Tell your students you are going to perform a magic trick. Turn the lights in the classroom off. Then turn them on. Ta da! The magic trick you have just performed was changing electricity into light. (You have to be tongue-in-cheek on this one.) Strike a match. You just performed another trick --chemical energy into light energy and heat energy!

EXPLORE. DISCOVER

2. Have a student run around his/her seat two or three times. They just performed a magic trick by changing chemical energy (digesting what they had for breakfast) into mechanical or motion energy.

3. Have a student demonstrate a battery-powered toy. Another magic trick--they changed chemical (battery) energy into motion or heat or light.

CREATE

4. K-l: Work in groups of 2 or 3. Older children can work independently. Give students a copy of "Ab Ra Ca Dab Ra" and be sure they have a pencil. Explain the directions.

EXPLAIN AND TAKE ACTION

5. Depending on your rubric for assessment, you can have students present their examples to the class and explain them. Or you can have the class classify each student's example as to whether it uses renewable or nonrenewable energy sources. Or you can expand the idea and have them build an imaginary device that converts one form of energy into another.

Remember that these assessments serve as guidelines only. You may wish to alter the task to suit the needs of our students.

Name_____.

Ab Ra Ca Dab Ra

Directions: The word on the left is one form of energy. Next to it, write in another form of energy. Then, draw or name an object that would change the first form of energy into the second form. If one doesn't come to mind, invent one. Explain what this new object does. (Include a safety rule!)

1. ELECTRICAL ENERGY changes into _____ ENERGY.

EXAMPLE:

SAFETY RULE:

1. RADIANT (LIGHT) energy changes into _____ ENERGY.

EXAMPLE:

SAFETY RULE:

REMEMBER: MRS CHEN

Rubric for Task Assessments

Fun With the Sun
Activities for Elementary Grades K-2

General Scale for Scoring Student Performance

SCORE	DESCRIPTION
5	Beyond expectations—quality of work is unusually high and beyond expectations
4	Meets expectation—skill is mastered to the level of expectation
3	Almost there—skill is almost mastered but with minor problems
2	The skill is present but with errors and omissions
1	The skill is absent

Energy Conservation

Activity 7/Task Assessment #4

Saving Energy

Activity 7/task Assessment #4 **SAVING ENERGY**

CONCEPT Everyone's help is needed to save energy and not waste it. Saving energy now saves our energy sources to use tomorrow.

GOAL Students will see the value of saving energy.

MATERIALS (per student):

Item	Amount	Where to find it
Drinking Straws	1-per student	Discount/Grocery
"Energy Use at Our House"(master)	1-per student	***Included in activity
"I Save Energy" Badge	varies	Teacher
Markers (from activity 1)	1-per student	Discount
Overhead marking pens	Teacher Use	Office supply
Overhead projector	Teacher Use	School
"Saver or Waster" (master)	1-per class	***Included in activity
Paper (construction, white)	1-per student	Discount

STRATEGIES

INVITE

1. Ask students to come up with ways to save energy. You may want to refer back to the flashlight and candle demonstration. Ask, "What are some ways to make batteries and candles last longer?" Ask "WHY is it important to make them last longer?" (Much of our energy is nonrenewable; we need some for later.)

EXPLORE. DISCOVER

2. Put "Savers or Wasters?" transparency on the overhead projector. Read each statement then ask students to tell you whether the statement is an energy saver (mark the blank with an "5") or an energy waster (mark the blank with a "W").

CREATE

3. Break students into work groups of 4. Give each student a piece of construction paper and a marker. Have them come up with a list of ways to save energy. You can make this a game where one child comes up with an energy-saving idea, writes it down, then he/she passes the marker to the person on their left and that child comes up with a different energy-saving idea. Move clockwise around the group until each child has at least 4 ideas. (Students can copy ideas from one another or come up with ideas of their own.)

For K-l, or non-writers, have a parent/volunteer at each group to record ideas. Or, be sure each group has an effective writer to act as recorder.

EXPLAIN AND TAKE ACTION

4. Have students share their lists with the class.

5. Distribute "Energy Use at Our House" sheet. Explain that students are to take this sheet home and with the help of a parent, draw, name or explain the objects that use energy in each room. Color the box representing the room that has the most energy-using objects. Challenge them to explain what energy forms are used, i.e., electricity, radiant, chemical (natural gas), etc. Refer to MRS CHEN.

6. Discuss the Assessment Rubric.

7. When students return to the class the next day, put a classroom bar chart on the board (or use a large piece of butcher paper). Have each student create the graph by coloring in only one appropriate block. For example, data for eleven children might look like the chart below. The twelfth student, whose kitchen is the highest energy user at his/her house, would take a marker and color in the block above "Kitchen" and next to "6."

Which Room Uses the Most Energy at Your House?

7				
6				
5				
4				
3				
2				
1				
# Of students	KITCHEN	BEDROOM	BATHROOM	LIVING ROOM

8. Discuss the chart so that students can see patterns in the data they created. Ask why a particular room was the greatest energy user. Ask about ways to save on some of the energy used in this room. How can they save on the energy used in all the rooms? What form of energy is used the most? (Probably electricity.) Why do we need to save energy? How much of the energy used in renewable?

9. Use this exercise as a task assessment to be sure that students understand ways to save energy and why it's important NOT to waste it.

FOLLOW UP

10. Have students make posters using their best energy-saving ideas.

11. You can use the "I Save Energy" Badge as an award for each student after they have successfully followed their energy-saving tips (either at home or at school.) Get parents involved. Children can write on the back of the badge how they saved energy. Have students tape the badge to a drinking straw and share with the rest of the class, i.e., a play or skit.

This activity can be used simultaneously as an Assessment. However, you may find it more useful to conduct a separate assessment.

SAVERS OR WASTERS?

Directions: Mark each sentence with an "S" if it SAVES ENERGY.
Mark each sentence with a "W" if it WASTES ENERGY.

_____ 1. Take a shower instead of a bath.

_____ 2. Turn lights off when you're not using them.

_____ 3. Use an electric can opener instead of a hand can opener.

_____ 4. Turn off the TV when nobody is watching.

_____ 5. Close the outside door on a warm day if you have an air conditioner turned on.

_____ 6. Stand in front of an open refrigerator while you decide what to eat.

_____ 7. Put on another sweater instead of turning up the heat in your house when it's cold outside.

NAME:_____

ENERGY USE AT OUR HOUSE

To the parent: Your child is participating in a class project that involves ways to save energy at home. Please assist your child in completing the chart below.

Directions: While at home, go into each of the rooms listed below. Look for items that USE ENERGY (electricity, natural gas, solar, wind, batteries, motion--like a ticking clock, etc.) Draw, name, or explain the objects in the blanks. Remember to take this paper back to school with you.

KITCHEN	**BEDROOM**
BATHROOM	**LIVING ROOM**

Energy
For The Future

Activity 8: Wind Detection

Student Assessments

Activity 8 **WIND DETECTIVES**

CONCEPT Wind is a renewable energy source.

BACKGROUND

Wind is a source or renewable energy because it is created by the sun. More specifically, wind is caused by the uneven heating of the Earth's surface. Because our planet is not perfectly smooth and because it is made up of water and land, some areas heat more quickly than others. Water takes a lot more energy to heat up than land does. Mountain tops heat up more quickly than valleys. Beaches heat up more quickly than oceans, and so on.

We have all seen heat waves rising off an asphalt parking lot on a hot, summer day. Warm air rises and so, warmer surfaces like a sandy beach will create currents of rising air while the air over the ocean will be cooler. As the rising air leaves the surface of the beach, it must be replaced—nature abhors a vacuum. So, cooler air from the ocean rushes in to replace the rising air. The greater the temperature differences between hot and cold, the faster the wind moves. Wind "dies down" when hot and cold air have been thoroughly mixed or when a large air mass moves in and creates uniform temperatures across the area. And so, all the rushing air is called *wind*. In the example above, the wind rushing in on the beach would be called a *sea breeze.*

Rising warm air creates low pressure. Thus, during the heat of the day, there will probably be low pressure over the sandy beach since the air is exerting less force down on the surface of the Earth. By comparison, the ocean will have high pressure since the air here is cooler and heavier. It exerts more force down on the surface of the water. Wind is created when air moves from HIGH pressure to LOW—or when air moves in to replace the currents that are rising.

Wind is always present and is a daily weather phenomenon. We often notice it when we see leaves move, flags outstretched, etc. You can point out to students that sometimes wind can be annoying because strong gusts can move us around or blow sand in our eyes.

GOAL Elementary students should begin experimenting with wind to understand that the energy in wind causes movement.

MATERIALS (per student):

Item	**Amount**	**Where to find it**
Aluminum Pie Pans	10-per class	Grocery/Students
Card Stock (wind wheel)	1-per student	Paper supply house
Crayons	Students can share	Discount
Electric Fan	1-per class	Teacher
Flashlight (from activity 6, need new battery)	1-per class	Discount
Globe	1-per class	School
"Make a Wind Wheel"	1-sheet/per student	***Included in activity
Pencils (new eraser)	1-per student	Discount/Grocery
Pipe cleaner	1-per student	Discount/Grocery
Scissors	Students can share	Discount
Soap Bubbles	1-Jar/per class	Discount
Straight Pins	1-per student	Discount

STRATEGIES

INVITE

10. Ask students to share stories about the wind. Perhaps some of them have seen a tornado or a hurricane.

EXPLORE. DISCOVER

2. Ask students "What makes the wind blow?" Depending on their level of understanding, you can illustrate this using a globe and a flashlight. Tell them the flashlight represents the sun. Have students

3. Discuss "How do you know the wind is blowing?" Examples of evidence should include: tree branches moving, flags flying, hair blowing in their face, etc. Remind students that it is the sun (flashlight) that causes the wind. And wind is a renewable source of energy. (Is wind found in MRS CHEN? No. It is not a form of energy; it is a source of mechanical or motion energy.)

4. Not only is wind a source of energy, it causes movement. Ask students what the source of energy is to run a windmill. (Wind, of course.)

CREATE PART I)

5. Tell students they are going to make "wind toys" to illustrate how the energy in wind creates movement. Most of the devices are things children are familiar with, but they may not have associated them with wind.

6. Give each student a pipe cleaner and have them twist the upper 213 into any shape they desire. Be sure the loop is complete and the end of the pipe cleaner is securely fastened. Tell them they are making a soap bubble wand. Ask: "What shape of 6ubble will you get from a round wand?" "What shape will you get from a square wand?" Encourage them to experiment to find out.

EXPIA/N AND TAKE ACT/ON (PART I)

7. Pour an inch or so of soap bubble solution into each pie tin. Spread these around the room to make it easier for students to have access to bubbles. Show them how to dip the pipe cleaner in, shake off the excess, and blow gently to make a bubble. Take one or two bizarre shapes and have students predict what shape the bubble will be. Then have students make bubbles to see whose predictions were right.

8. After they have experimented with different designs, have them put the pipe cleaners away and pour the extra soap solution back into the bottle. Hand out "Make a Wind Wheel" along with scissors.

CREATE (PART II)

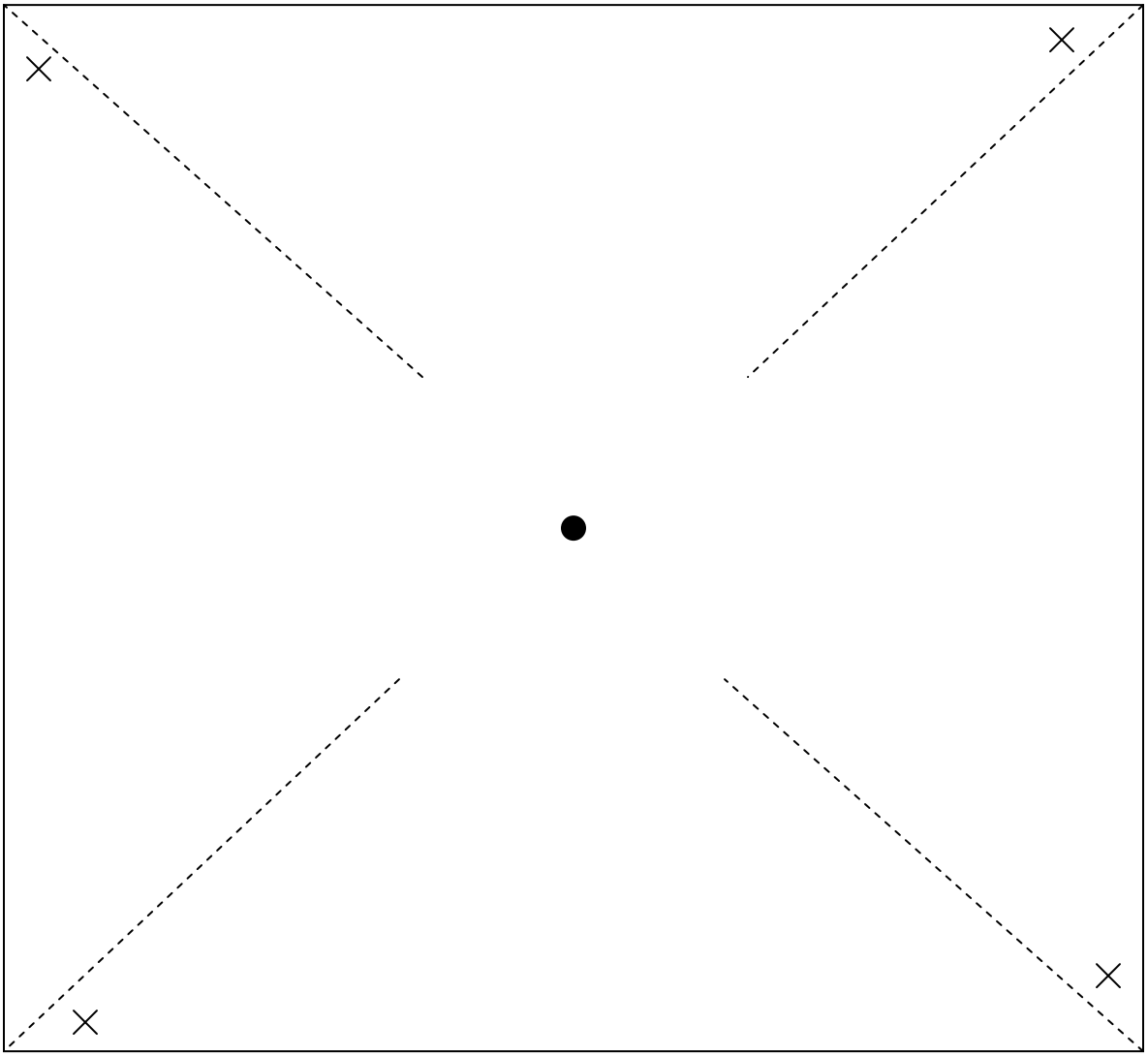
9. Follow the directions at the bottom of "Make a Wind Wheel." Hand out pins and pencils. You will need to fasten the pin to the eraser for them. Be sure the wheel moves freely.

EXPIA/N AND TAKE ACT/ON (PART II)

10. Have students draw and color designs on the wind wheel. They can experiment with motion by drawing large (l-inch) squares around the wheel, then see what shapes they get when the wheel turns. Students can also experiment with color. Have them draw red stars alternating with blue stars in a line all the way around the wheel. See what colors they get when the wheel turns.

NAME_____

MAKE A WIND WHEEL



Materials: scissors, pins, pencils or straws

1. Cut in at each corner.
2. Take the corners marked X and fold up to center.
3. Pin all corners to the center.
4. Pin on eraser of pencil or plastic straw.

Your wind wheel should look like this:

Teacher: Run this on heavy paper such as oak tag.

STUDENT ASSESSMENTS

The following additional assessment tasks are provided to help you plan ways to evaluate each student's growth during this unit. They are in no way official assessments of the state standards. Some teachers prefer to use the activities themselves as assessment tools. Others design their own.

Use the rubric included in this kit for any of the assessments below. Again, rubrics should be modified to meet your needs and the needs of your students.

If you would like to share your assessment/rubric idea with other teachers, please make a photocopy of your assessment plan and rubric and return it with the kit of supplies. With your permission, it will be included in future guides for other teachers.

Assessment Idea #1

Review the chart of "Ways to Save Energy." Talk about how everyone's effort makes a difference. Ask for ideas on other ways to save energy that aren't on the list.

Ask students to draw a picture or build a model or write a story or tell a story about an ENERGY MONSTER--a thing that wastes energy; a monster that doesn't pay any attention to the ways we can save energy. (The monster can be made of old, worn out batteries that are not reusable or it can have light bulbs for eyes, sipping on a glass filled with oil, and so on.)

Assessment Idea #2

Draw illustrations or cut out pictures from magazines of toys that use energy. Explain what source of energy is needed for each toy (wind, electricity, food, water, battery). Build your own toy using ideas from this kit.

Assessment Idea #3

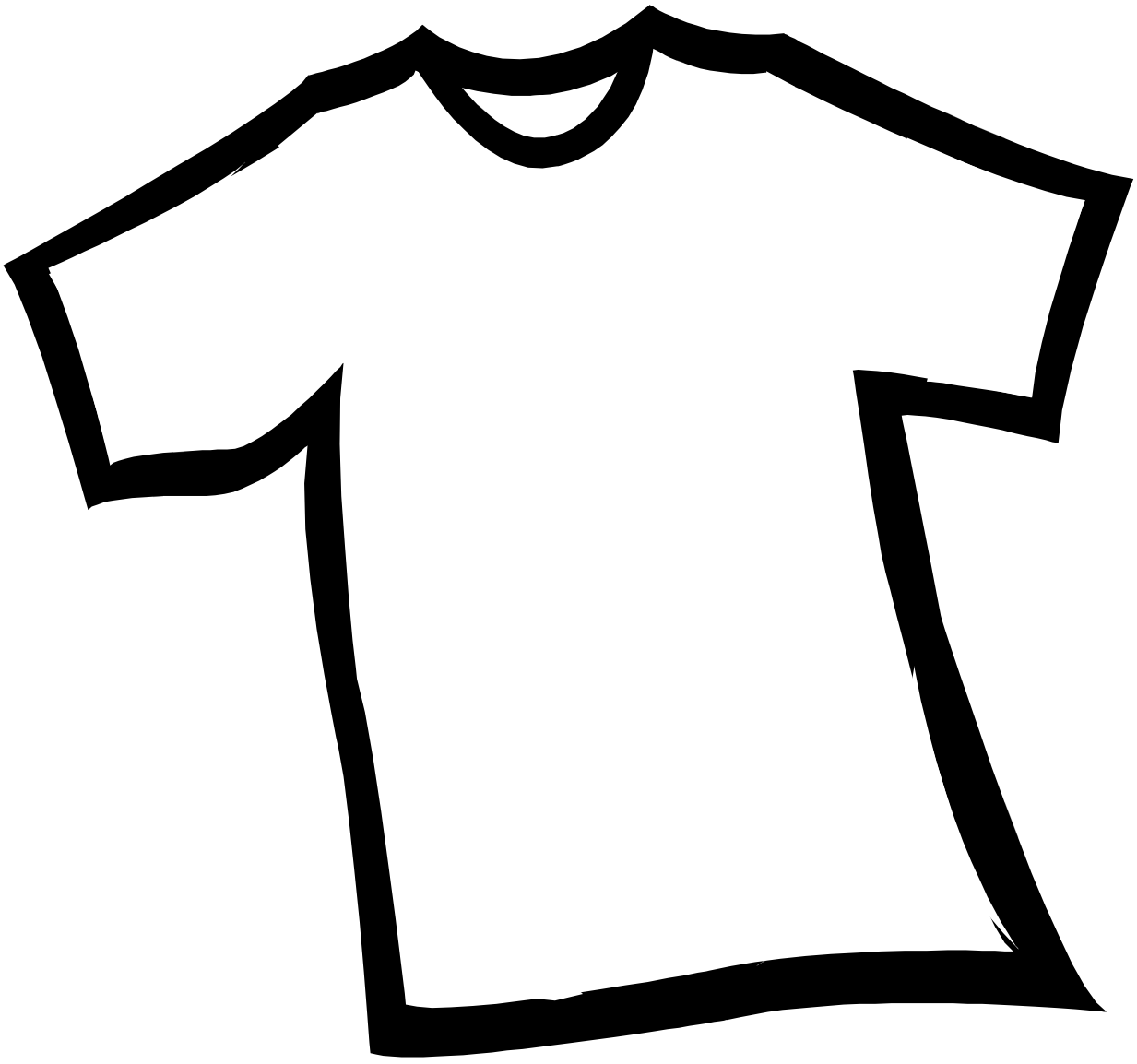
Make a word splash (scatter words on a page) using vocabulary learned in this unit. Explain what they mean. Draw arrows or boxes to make connections between the words. Explain the connections.

Assessment Idea #4

Design your own t-shirt with the slogan "I SAYE ENERGY." (See the pattern on the next page.) You can display the designs on a clothesline or on a bulletin board.

NAME_____

Design your own T-shirt with the slogan "I SAVE ENERGY."



Rubric for Task Assessments

Fun With the Sun
Activities for Elementary Grades K-2

General Scale for Scoring Student Performance

SCORE	DESCRIPTION
5	Beyond expectations—quality of work is unusually high and beyond expectations
4	Meets expectation—skill is mastered to the level of expectation
3	Almost there—skill is almost mastered but with minor problems
2	The skill is present but with errors and omissions
1	The skill is absent

FUN WITH THE SUN

Activities for Elementary Grades K-2

Evaluation

In our continuing effort to improve our education programs, the Education Programs Office at NREL would appreciate your taking a few minutes to complete the following evaluation. **Please return this form NREL Office Education Programs, 1617 Cole Blvd, Golden, CO 80401 or Fax 1-303-275-3076. Thank you.**

School_____ School District_____

Approximate Ethnic Distribution of your Class:

_____% African American _____% Hispanic _____%Asian
_____%Native American _____%Caucasian _____%Other

Gender Distribution of your Class:

_____%Girls _____%Boys

1. With what grade level did you use this material? K 1 2 Other (specify) _____

2. What was the length of time you needed to teach the entire kit?_____ days

Please circle the number that is the most appropriate response to the question.

	Strongly Agree				**Strongly Disagree**	
3. The Teacher's Activity Guide was organized and easy to follow.	5	4	3	2	1	n/a
4. Background information was clearly written and was useful in understanding the content area.	5	4	3	2	1	n/a
5. Key terms were explained, understandable and useful.	5	4	3	2	1	n/a
6. The activities, overall, were useful in motivating students.	5	4	3	2	1	n/a
7. The activities were appropriate for K-2 grade level.	5	4	3	2	1	n/a
8. The assessments, overall, provided useful feedback on student progress.	5	4	3	2	1	n/a
9. The rubrics provided easy-to-measure guidelines.	5	4	3	2	1	n/a
10. The kit of materials was well supplied and helped in the teaching of the activities.	5	4	3	2	1	n/a

(Over, please)

Please rate each of the activities according to your overall sense of the ease of implementation, appropriate level of content, and student motivation.

	Excellent		**Fair**		**Poor**	
11. Activity 1: Sunbeams	5	4	3	2	1	n/a
12. Activity 2: Energy Collage	5	4	3	2	1	n/a
13. Activity 3: Where Does It Get Its Energy?	5	4	3	2	1	n/a
14. Task Assessment #1: Energy Classifications	5	4	3	2	1	n/a
15. Activity 4: Do Electrical Appliances Save Time?	5	4	3	2	1	n/a
16. Activity 5: Safety with Electricity	5	4	3	2	1	n/a
17. Task Assessment #2: Energy Used/Limits	5	4	3	2	1	n/a
18. Activity 6: A Bright Idea	5	4	3	2	1	n/a
19. Task Assessment #3: Energy Conversion	5	4	3	2	1	n/a
20. Activity 7: Saving Energy/ Task Assessment #4	5	4	3	2	1	n/a
21. Activity 8: Wind Detectives	5	4	3	2	1	n/a
22. Students Assessments	5	4	3	2	1	n/a

Please add any additional comments below. (If you have changed the format of any activity or if you have developed your own assessment/rubrics, please include a copy with this evaluation. We will include it in the next edition of the **Fun With the Sun Activity Kit.)**

THANK YOU FOR YOUR FEEDBACK!