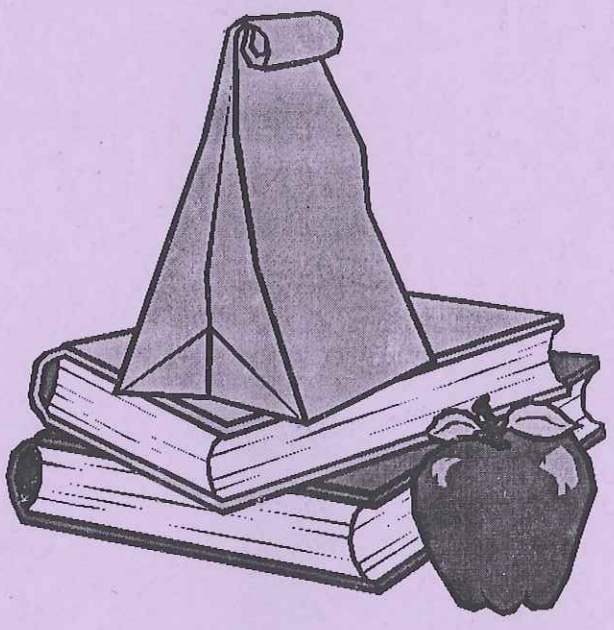
Energy Education Resources for Elementary Schools



A Compilation of Lesson Plans and Activities for Grades K-6

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Dear Educator,

This packet contains a selection of energy education related lesson plans for the K-6 grade levels. The packet was compiled by three HSU students as their environmental science senior project.

The lesson plans in this packet are a representation of the large variety of curriculum available to teachers interested in bring energy education into the classroom. There are many more energy education resources available to elementary school teachers beyond what is contained in this packet. A listing of additional online resources for teachers interested in pursuing this exciting topic further appears at the end of this booklet.

We hope that you and your students will find these lesson plans helpful and stimulating. Energy awareness begins while we are young – today's students are tomorrow's energy consumers and decision makers. By incorporating energy education into schools today we can all look forward to a brighter future.

Best wishes in your energy education pursuits!

Energy Education Resources for Elementary Schools

Table of Contents

Energy: Background Information

Energy Sources

Lesson Plan also located online at: http://www.ase.org/educators/lessons/ex1.pdf

Subjects: Science, Environmental Science, Social Science, Language Arts, Health
Process Skills: Listening, reading, writing, grouping facts, conducting research
Grades: 4-6
Cognitive Task Level: Average to difficult
Time for Activity: 30 minutes to start, then as a homework assignment

Key Vocabulary:
Chemical, jojoba, organic, fossil, nuclear, electricity, hydraulic, hydroelectric, petroleum, windmill, refuse

Intended Learning Outcomes:
Completing this activity will allow students to:

- Observe different types of energy sources
- Learn more about energy and where it comes from
- Conduct their own research reports on energy sources.

Background

Sources of energy are all around us, and come in a variety of different forms. Energy for a person is different than energy for an automobile. In this activity, the teacher demonstrates several different types of energy, and assigns a research report topic for small groups of students.

Materials

- Picture of the sun (optional)
- Fruit or vegetable
- Container of vegetable oil
- Piece of firewood
- Piece of charcoal or coal
- Container of motor oil
- Gas lighter
- Cup of water and an empty cup
- Child's pinwheel
- Picture of lightning or a light bulb
- Picture of a nuclear power plant
- Piece of discarded trash
- Battery

Procedure

1. Using the information on pages 3-4, demonstrate the different energy sources. Write the names of the different types of energy sources on the chalkboard.

2. Once students have received their introduction to energy sources, inform them that they will be conducting research reports to find out more about their energy sources. Break the class into groups of two or three students. Assign each group a different energy source. Instruct each group to complete a three-page report about the energy source. Since the project will be a collaborative effort between two or three students, encourage the students to divide the work, so that each student contributes a section to the final report.

3. Take a trip to the library. Work with the librarian to show the students how to find the information they need to complete the report on their energy source. Be sure they know how to use the encyclopedia and other resources. Provide time for the students to do their research, work together in their groups and write the report.

4. After the reports are completed, have each group give a five-minute presentation about the energy source they studied.

5. After all the presentations have been given, initiate a discussion with your class about what they learned. Ask your class to choose the safest energy source, the most efficient energy source, the energy source that's least destructive to the environment and the cheapest energy source. Then, write a list of the energy sources on the board, and have the class vote for the "best" source. You may have them vote for the top two or three.

Extensions/Modifications

- As a simpler version of this activity, assign the energy words as homework vocabulary assignments to your students. Have them complete sentences using the words.
- An even simpler version of the activity would be to simply conduct the demonstration as described in the activity.
- To extend this activity, have each student write a one-page essay on which three energy sources they would choose as the "best" sources of energy for the world. Tell them to explain why they chose what they did. This can be given as an in-class assignment or as a homework assignment. When the essays have been completed, ask some students to read theirs aloud. Display the completed essays in the classroom.

Energy Sources

Sunlight: Point to the sun, or hold up a picture of the sun. The light that comes to the earth from the sun is pure energy. The sun is the original energy source. Nearly all other sources of energy originally got their energy from the sun. Organic matter, like plants, convert solar energy into leaves, flowers and fruits. Animals, which eat organic matter, convert the energy into body mass. When animals die, their energy is decomposed and over extensive time, becomes stored as oil, coal or natural gas.

Food: Hold up an apple, orange or other fruit or vegetable. Food is the source of energy used by people. Food that we eat is digested, and the stored energy is used by the body to keep the heart beating, the blood pumping and the body growing. When a body has "low blood sugar," the body needs to eat and process more energy, so we can continue working, playing and growing.

Organic Oils: Hold up a bottle of vegetable oil. Vegetable oil and animal oil have played an important role in human history. Vegetable oils, like olive oil, corn oil or safflower oil, are often used in cooking. Jojoba oil (from the jojoba bean) is used in cooking or lubricating, as well as in lotions and soaps. Animal oil, like that from whales, seals and livestock, was used in the past for lighting lamps as well as for waterproofing.

Wood: Hold up a piece of firewood. Wood comes from trees, which are, of course, plants. The plants got their energy from the sun. When trees are cut down and burned, they release their energy in the form of heat. Many homes are heated with wood-burning stoves.

Fossil Fuels:
The following three energy sources come from prehistoric fossils. Like the methods described above, ancient plants absorbed the energy from the sun and converted it into more plants. Ancient animals, like dinosaurs, ate the plants. When the plants and animals died, their remains collected under mountains of earth and, over millions of years, they decomposed into a source of fuel. The remains of these plants and animals are what we refer to as fossil fuels.

Coal: Hold up a piece of charcoal, or, if possible, a piece of real coal. Coal is burned to heat homes and run electrical machinery. About 20 percent of the energy we use comes from coal.

Oil: Hold up a container of motor oil (preferably in clear plastic so students can see the oil). Other petroleum products similar to motor oil are burned to fuel motor vehicles and heat homes. About 45 percent of energy used comes from oil.

Natural Gas: Hold up a lighter, and light it. Natural gas is used to heat the homes of many people. About 25 percent of the energy we use comes from natural gas. The fuel used in lighters is not the same as the natural gas used to heat homes, but the lighter can be used as an example. Most of the energy used by people today comes from these fossil fuels. But fossil fuels are limited in their supply, can pollute and are sometimes hard to find.

Other Energy Sources

The following energy sources not require the sun. They are derived from other aspects of the earth's ecosystem.

Water: Pour water from one cup to another, simulating a waterfall. Water is not an energy source, but water is used to generate energy. Water falling downhill is used to run turbines, which generate electricity. This is called hydroelectric power. About 5 percent of the world's power is now produced by hydroelectric dams. A similar type of energy comes from geothermal energy. Pockets of boiling water under the earth's surface send steam to the surface of the earth. This hot water also can be used to generate electricity. Dams can impede the movement of fish up and down river to reach spawning grounds or for other migratory purposes.

Wind: Hold up a pinwheel and blow on it. Winds that blow can be used to turn windmills, which generate electricity. Windmills have been used for centuries in some parts of the world, like Holland. Windmills are also used in the United States.

Electricity: Hold up a picture of lightning, and/or a light bulb. An electrical storm contains a great deal of natural electrical energy. Benjamin Franklin first proved that lightning was electricity in 1752. His discovery helped scientists learn how to harness electricity and how to generate electricity from other methods. The electricity we use today was created by other sources, not by the energy released by lightning.

Nuclear Power: Hold up a picture of a nuclear power plant. Nuclear power comes from the radioactive ore uranium. It produces far more power per ton than any other energy source. Nuclear power does not contribute to air pollution. However, radioactive waste is very hazardous to living things. Exposure to radioactive materials can result in mutations, illness or death. The drawback to using nuclear power is finding a safe place to dispose of the nuclear waste. About 6 percent of the energy used in the world comes from nuclear power.

Refuse-derived fuel: Hold up a piece of discarded trash. Now, we are able to extract energy from garbage! Garbage is burned in a waste-to-energy facility. As it burns, water pipes are heated. This hot water is used to generate electricity. Most waste-to-energy facilities produce enough energy to run the plant and supply additional power to the community. This is a small but growing source of energy.

Chemical energy: Hold up a battery. Batteries create energy through chemical reactions. When different chemicals react with one another, energy is released. Eventually the reaction stops, and the battery must be replaced. Batteries are used in motor vehicles and many smaller appliances, like clocks, hearing aids and toys.

Energy Activities

Lesson plan also located online at: http://www.ase.org/educators/lessons/ex.%202.pdf

Background

Everything that occurs in the world comes about as an exchange of energy. But energy cannot be seen, heard, felt or touched. It is invisible, yet it's the force that makes life possible. Trying to explain energy can be very difficult. These simple activities allow children to observe the effects of energy. With some guidance, the students can develop their own explanations for how these events happened, and, in the process, gain greater understanding of the nature of energy.

Subjects: Science, Environmental Science, Language Arts
Process Skills:
Hands-on manipulation, teamwork, verbal communication, following directions
Grades: 3-4
Cognitive Task Level: Average
Time for Activity: 30 minutes

Key Vocabulary: Gravity, force, electricity, solar, hydroelectric, windmill
Intended Learning Outcomes:

- Completing this activity will allow students to:
- Conduct experiments to learn about how energy works in our world
- Observe changes that occur due to the forces of energy
- Work in groups to explain the phenomena they observe.

Materials

- Watch or clock with second hand
- 2 thermometers
- 6 tart pans, 3 inches in diameter (one pan painted black)
- Solar calculator
- Desk lamp
- Rock, about 4 inches high
- Flat board, about 1 foot by 18 inches long
- Toy car
- Newspaper
- 2 cups of ice
- Paper cut into 3-inch by 6-inch strips
- Paper cut into 3-inch by 2-inch squares (4 per experiment)
- Tape
- Unused pencil
- Paper
- Paper clips
- String
- Handouts (on pages 7-9)

Procedure
This activity is best conducted outdoors in an area protected from the wind.

1. After a discussion of energy and its various forms, direct your students in these energy experiments. Divide the class into two groups. Hand out the Energy Experiments worksheet.

2. Have one group perform the solar, cooling and heat experiments. Have the second group perform the gravity, physical, insulation and wind experiments. Hand out the necessary materials to each group. You may want to instruct the groups to divide the activities so that one or two students conduct each experiment, or have the whole group go through each experiment together. Some experiments take longer than others. Have the students plan their time so that they can complete the experiments in the time allotted for the activity.

3. Be available to assist your students in their experiments or in their explanations of what happened. Guide them through difficult explanations.

4. When all the experiments are completed, take a few minutes and have your students explain the experiments to each other. Have each group explain to the others what experiments they conducted and how they worked. Be sure they clean up the remains of the experiments.

5. When everyone is back in their seats, use this period to test for knowledge. Randomly ask students about each of the different experiments. If they communicated well with each other, each student should know the answer, or be able to guess at the answer. If necessary, explain the concepts again at this time.

Extensions/Modifications
- To expand this activity or make it more difficult, look up more energy experiments in books and curricula.
- To simplify this activity, you may choose to conduct the experiments as part of a demonstration and discussion activity.

Energy Experiments

Name_____

Experiment 1 Materials:

- Watch or clock with second hand
- 2 thermometers
- 6 tart pans, 3 inches in diameter (one pan painted black)
- Water
- Solar calculator
- Desk lamp

Solar:

1. Solar energy creates electricity using solar cells. A solar calculator provides an example of this. Using the calculator, make a simple calculation. Then find the solar cells and cover them with your finger for 30 seconds. Keep your finger on the solar cells and try to make the calculation again. What happens?

2. Set out an unpainted aluminum pie tin and a second tin, painted with black paint. Fill both pans with exactly the same amount of water. After ten minutes, check the temperature of both pans. What are the differences? Why did this occur?

Cooling:

3. Place one aluminum pan with water in it in the sun. Place another under a shady tree. After ten minutes, check the temperatures of the water in the pans. Which is warmer? Why?

Heat:

4. Place a desk lamp over an aluminum pan with water in it. Set a second one, with the same amount of water, away from the lamp. After ten minutes, check the temperature of each. Which is warmer? Why?

Energy Experiments

Name_____

Experiment 2 Materials

- Rock, about 4 inches high
- Newspaper
- Flat board, about 1 foot by 18 inches long
- 2 cups of ice
- Toy car

Gravity:

1. Place a board over a rock so one end is higher than the other. Place a toy car on the incline. What happens? Why? Try placing the board flat. Does the car move? Why not?

Physical:

1. Place a rock on the ground. What happens? Now place your hand behind the rock and push gently. The rock moves. What makes the rock move?

Insulation:

3. Place a cup filled with ice in the sun. Wrap newspaper around a second cup of ice, an place it in the sun. The ice in which cup melts faster? Why?

Energy Experiments

Name_____

Experiment 3 Materials

- Paper cut into 3-inch by 6-inch strips
- Paper cut into 3-inch by 2-inch squares (4 per experiment)
- Tape
- Unused pencil
- Paper
- Paper clips
- String

Wind:

1. Wrap the large piece of paper around the pencil. Tape it. Make sure it fits loosely Tape the four squares to the paper. Tie the paper clip to the string and tape the other end of the string to the paper tube.

Blow on the blades of paper. You have created a windmill! The wind from your blowing on it should cause the tube to turn, and it should wind the string with the paper clip up the tube. Why does the windmill turn?

Activity: Yesterday and Today

Lesson plan also available online at:
http://www.ase.org/educators/lessons/YesterdayandToday.html

Subjects: Science, Math
Objectives:
The student will do the following:

1. Interview someone who grew up before the days of great electricity usage.
2. Dramatize the changes in lifestyle due to increased energy usage today.
3. Compare average monthly electricity usage for his/her family and the families of his/her parents and grandparents.

Time: 90 minutes, plus take-home activities

Key Vocabulary

- labor-saving devices: devices developed to decrease or replace human labor, especially manual labor.
- lifestyle: the way of life which is characteristic of an individual or a group of people.
- standard of living: the degree or level of material well-being of an individual or group.

Background

Many people call the past the "good old days". Although it is common for people to be nostalgic, most would not throw out their machines, conveniences, and leisure time, and return to the "good old days" of our grandparents' childhoods, when most work was done by animal and human muscle power. Our nation's standard of living is much higher than it was only 50 years ago. Much of this is due to the development and heavy use of energy-consuming devices. Our dependence upon these devices has caused a great increase in the amounts of energy we use each day. This is easily demonstrated by an examination of household energy use for normal daily operations. Electricity is our energy form of choice for household use, so consideration of our families use of electricity as compared with electricity use by the two generations preceeding us will show how much more energy we use today.

Materials: Teacher sheet (included), student sheets (included)

Procedure

1. Setting the stage

A. Share the background information with the students, defining and discussing the terms with which the students may not be familiar.

B. Read to the students the story on the teacher sheet "APRIL 1937," included. Lead the students in a discussion of their thoughts on the days of their grandparents.

C. Have the students bring in pictures of scenes representative of the past and the present. Together with the students, discuss how the pictures differ.

2. Activity

A. Have the students conduct interviews to learn more about lifestyles in the past.

1. Give each student a copy of the student sheet "THE GOOD OLD DAYS?," included.

2. Have each student identify someone at least 50 years old (a grandparent, neig
friend or other acquaintance) who would be willing to participate in an intervie
(NOTE: You could invite several senior citizens to the classroom to answer the
students' questions.)

3. Together with the students, read and discuss the directions and questions on
interview sheet. Give the students some pointers on successfully conducting
interviews.

4. Have the students return their completed interview forms after they have
conducted the interviews.

B. Have the students compare their use of energy-using devices to their parents' and
grandparents use of household appliances.

1. Give each student a copy of the student sheet "TODAY AND YESTERDA
included. Explain that completion of the handout will help them see how the us
electricity has increased over the past 50 years. They are to check the listed
appliances that their families use now.

2. Have the students check with their parents for the appliances they used when
were children. Have the students mark the appliances they think their grandpare
might have used. They may use information from their interviews or ask their
grandparents about the listed appliances.

3. Tell the students the following information:

> If you had lived in the year 1900, you probably would have used only on
> fourth of the total energy you use today. You probably would not have u
> any electricity at all. In the year 2000, you probably will use much more t
> you use today.

4. Ask the students what might happen as energy demand increases still more.

3. Follow-up

A. Have the students discuss and list ways they might alter their lifestyles to match t
lifestyles of yesterday.

B. Divide the students into two groups and have them write and perform skits show
the difference between lifestyles today and 50 years ago. Have them focus on how
lifestyles have changed due to increased use of energy today.

C. Have each student select the role of a character from history and write a journal e
with an energy slant.

APRIL 1937

It is April 1937. Roy, a nine-year-old boy, and his eleven-year-old sister, Margie, live on a farm; most of the families in the Tennessee Valley do.

The day begins at 4:30 am., when their mother's wind-up Big Ben alarm clock can be heard all over the house. Mother is the first one into the cold kitchen, where she lights the fire in the wood stove and gets breakfast started. Roy and Margie get dressed and go to the barnyard to do their chores. They do the milking first. Roy carries the milk buckets to the root cellar where it is cool; they do not have a refrigerator. He then feeds the cow, the mule, and the pigs. Margie helps Roy with the milk, then feeds the chickens, collects the eggs, and takes some milk from the root cellar for breakfast. Father checks the garden to see if the soil is dry enough to plow, then goes to the shed and begins getting the harness and yoke ready so that he can hitch the plow to the mule, Sadie. Plowing is Sadie's and Father's job; tractors are rare in this part of the country.
Mother calls them to breakfast and they hurry in to sit down to a meal of sugar-cured ham, eggs, just-baked biscuits, and homemade jam.

After breakfast, Roy and Margie draw the water needed for the day's cooking and washing. Then they walk two miles to their one-room school house, carrying their books and lunch pails. There is only one teacher; she not only teaches all the subjects and all the students, but she is responsible for maintaining the school. She has arrived early to light a fire in the school's wood stove; the April morning is chilly and the warmth from the stove will feel good.

While the children are at school, Father and Sadie plow the rest of the garden. The garden's tomatoes. beans, corn, and other vegetables make up most of the family's diet for the year. As he plows, Father hopes the weather this year will be good and that the government agents will bring him some more fertilizer for his crops. Last year's garden supplied the family with enough corn meal and canned and dried vegetables to make it through the winter; there was even enough to sell some.

Mother builds a fire under the big black pot filled with water and washes the clothes. Some she scrubs on a washboard. Then she hangs them on a line to dry. She puts a big pot of pinto beans on the wood stove to cook all day. Later, when the clothes are dry, she irons them with a flat iron that she heats up over the fire and reheats after every few garments.

After they walk home from school, Roy and Margie work on their lessons. Then they play outside for a little while, and return to the barnyard to do their evening chores. The cow must be milked again and the animals must be fed and tended. For supper, Mother serves the pinto beans, some fried potatoes, and a large pan of cornbread. The family is thankful the garden has supplied enough vegetables for the year. When they finish supper, Margie washes the dishes in a pan filled with water heated on the stove,

Mother puts away the dishes, and Roy and Father chop the wood and fill the wood box for the next day's use.

When the chores are finished, Father reads a story by the light of the kerosene lamp. Mother sits down at the pump organ and they all sing some songs together before retiring. The bedrooms are chilly so they snuggle in their beds under quilts Grandma made.

Roy and Margie look forward to going to their cousins' house on Saturday night, where the family gets together to listen to the Grand Ole Opry on the radio. Their cousins live much closer to town and have electricity. When it is time to go home, they will climb back in the wagon hitched to Sadie. Some of their relatives have cars or trucks. Roy and Margie hope Father will soon have enough money to buy one. He says the Great Depression is over and times are getting better, so maybe they will soon be able to buy some things the family does without.

Roy and Margie look forward to summer vacation. School will end in May. There will be much to do to care for the garden and the animals and to harvest and preserve the vegetables, but there will be time for fishing in the stream, swimming in the swimming hole, and picking berries.

Too soon it will be September. Most of the crops will be harvested and Father will have the money he makes from selling what the family will not need. It will be time to buy each one's new pair of shoes. Roy and Father will get new overalls. Mother and Margie will pick out some material for making new dresses. There will be much work to do to prepare for another winter. There is always work to do on the farm.

THE GOOD OLD DAYS?

Name_____

Interview someone who is old enough to remember what life was like before the usage of electricity became so common. Be sure he or she is at least 50 years old. Ask the questions that follow. You may think of other questions to ask also.

1. What kind of lights did you use in your home? _____

2. How was your home heated? _____

3. How was it cooled?_____

4. Of what fabrics were clothes made?_____ Was clothing harder or easier to care for than clothing today?

   _____

   What kind of washing machine did you have? _____

   How was laundry dried? _____

5. What kind of stove and/or what kind of fuel did your family use for cooking?_____

6. Did you have a refrigerator? _____ If not, how did you keep your food fresh?_____

7. How was food packaged when it came from the store? _____

   Did your family grow much of its own food? _____

8. What sorts of items did your family purchase?

   _____ What sorts of items did your family make for itself? _____

9. What did milk come in? _____ Was your milk delivered? ____ If so how?_____

10.What sort of soap did you use? _____ Did it clean as well as the cleaners we have now? _____

11.How was your water heated for bathing, dishwashing, and laundry?

_____

12.Did your family have a car? _____ If not, how did you travel?_____ How did you get to school?_____

13.Did you have a radio? _____ What did it look like?_____ Did you go to the movies? _____ What other kinds of entertainment did you enjoy?

_____

14.Make a list of additional questions. Ask them during the interview. Put the questions and answers on the back of this page.

15.To close the interview, ask the following questions and write the answers below. I more space is needed, use the back of this page.

a. In what ways is life more enjoyable now that we have much electricity and have many more products?

_____

_____

_____

b. In what ways did you like the "good old days" better?

_____

_____

_____

TODAY AND YESTERDAY

Name_____

This is a list of electric appliances found in many homes today. Electricity is measured in kilowatt hours (kWh), just as gasoline is bought by the gallon. The average number of kWh each appliance uses in a month is given. Write the number of kWh for each appliance your family uses in the column "Your Family." Do the same for your parent's family and your grandparent's family. Add the kWh for each column to see how many more kWh of electricity we use than did our parents and grandparents.

APPLIANCE	AVERAGE ELECTRICITY (kWh) USED IN ONE MONTH	YOUR FAMILY	YOUR PARENTS FAMILY	YOUR GRAND-PARENTS FAMILY
Dishwasher	35			
Microwave Oven	16			
Electric Range	98			
Blender	1			
Can Opener	1			
Electric Clock	1			
Automatic Coffeemaker	8			
Toaster	3			
Slow Cooker	12			
Refrigerator	152			
Vacuum Cleaner	4			
Clothes Washer	9			
Electric Clothes Dryer	80			
Space Heater	75			
Electric Water Heater	400			
Color TV	55			
B&W TV	30			
Radio/Record Player	9			
Electric Blanket	12			
Hair Dryer	10			
Electric Toothbrush	1			
Room Air Conditioner	72			
Electric Fan	12			
Electric Furnace	1100			
Yard Light	30			
Garage Door Opener	1			
TOTALS:				

Energy Usage

How Much Energy Do You Use?

Lesson plan also available online at: http://www.ase.org/educators/lessons/ex.4.pdf

Subjects: Science, Math, Social Studies, Home Economics
Process Skills: Counting, multiplication, use of calculators, comparing, data gathering
Grades: 3-6
Cognitive Task Level: Average to difficult
Time for Activity: 15 minutes preparation, one day's homework, 20 minutes classwork
Intended Learning Outcomes:
Completing this activity will allow students to:

- Observe the items that use energy in their own homes
- Calculate the energy cost for their own homes
- Compare this cost with others in their class and with the national average.

Background

U.S. residents use more energy now than we ever have in the past. There are many reasons for this. As more people populate the country, energy needs rise. Technology advances, such as industrial processes, sophisticated machinery and computers also require increased energy. Our everyday lives are filled with electrical appliances that our grandparents never used.

Why is our energy bill so high? This activity gives your students a chance to work on some real-life math problems. This activity bases its numbers on cost figures from one utility. Energy figures in your area may be different. Your local energy utility can give you figures that show the average expenditure per household in your community.

Materials
Calculators
Handout: Energy Home Survey worksheet (page 19)

Procedure
1. Start by asking your students if they ever heard their parents complain about the cost of energy. Explain that the monthly utility bill is directly related to the amount of energy the household uses, and that this activity will help them find the "energy-eaters" in the house.

2. Distribute the Energy Home Survey worksheet and assign the homework.

3. When students have completed the homework assignment, assist them in answering the questions and completing the math.

4. Ask them if they found appliances in their homes they think they could live without, such as an electric can opener or an electric plate warmer.

Extensions/Modifications

- A good introduction to this activity is to encourage students to ask a grandparent, or older relative or neighbor about what life was like when they were children. Many grandparents grew up before television, commuter flights and digital clocks. The student could interview the senior and write a report comparing an aspect of energy use "then" vs. "now."

Energy Home Survey

Name_____

Do this survey twice: once in the morning before school, and once just before dinner. It will help you determine how much energy you use.

Appliance Electrical Appliances	Multiply by	Subtotal	Total per day
Incandescent Lights: Number of lights on =	1 cent per hour		
Fluorescent lights: Number of lights on =	1 cent per every 4 hours		
Television: Number of sets on =	4 cents per hour		
Radio: Number of sets on =	1 cent per hour		
Stereo: Number of sets on =	2 cents per hour		
Microwave oven: Number of ovens on	15 cents per hour		
Computer: Number of computers on =	1 cent per hour		
Vacuum cleaner: Number on	9 cent per hour		
Portable heater: Number on =	15 cents per hour		
Air conditioner: Number on =	55 cents per hour		
	Total for all subtotal usage		
		Total usage in one day	

Add up all the numbers in the Subtotal column. This subtotal is the total cost for these appliances in one hour.

Some of these appliances will be on for more than one hour, some less. Based on what you know about your household, write the total number of hours and the total cost in one day for these appliances in the Total per day columns above.

(Example 1: If two stereos are on for eight hours a day, you multiply 2 (stereos) x 2 cents per hour x 8 hours = 32 cents per day. Example 2: If you vacuum for 1/2 hour, multiply by 9 cents per hour x .5 hours = 4.5 cents per day.)

Periodic Appliances
Some items are not used all the time. They create a cost only when they are used.

Periodic Appliances Appliance and loads per month	Multiply by	Total per month
Dishwasher:		
Loads =	10¢ per load	
Washing machine:		
Loads =	5¢ per load	
Electric clothes dryer:		
Loads =	67¢ per load	
Gas clothes dryer:		
Loads =	16¢ per load	
Total usage for one month		

These answers give you the total cost per month, based on how much your family uses these appliances.

Periodic Appliances: Appliance and average use per month	Total per month
Gas water heater:	$13.00
Electric water heater:	$45.00
Refrigerator:	$16.00
Extra freezer:	$18.00
Electric heating system:	
Small home:	$85.00
Large home:	$250.00
Gas heating system:	
Small home:	$28.00
Large home:	$120.00
Total for 1 month	

With your teacher's help, try to figure out your home energy costs for one month. Compare it to the bill that your parents receive each month. How do they compare?

My estimate: _____

My parent's bill: _____

Did your estimate come close to the actual cost? If not, why do you think they differ?

Activity: Let's Get Energized -- The Pay Me Game

Lesson plan also available online at:
http://www.ase.org/educators/lessons/paymegame.htm

Objective: Students will use play money to understand the dollar cost of their energy habits.
Materials:

- 2 envelopes, 1 marked "me" and 1 marked "utility"
- Play money $100 per student (Use play money from board games or see master sheet at http://www.ase.org/educators/lessons/paymegame.htm)
- One copy of Pay Me Game Questions

Time Frame: 20-30 minutes
Suggested Audience: grades 3 to 6
It works well to pair an older student with a younger one to help in the process of making change.

Procedure

1. Cut out the money sheets. Each student should have $100 made up of 20- $1s, 10 - $5s, and 3 - $10's. Students can put the money into piles prior to starting the activity.

2. Give each student one: "me" envelope and one "utility" envelope.

3. Tell students that they have just gotten paid $100, and whatever they and their family don't spend on energy at home, they can use to buy the things they *want.* Read each question to the group. Depending on their answer, the students will put the required amount of money in either their "me" envelope or in their "utility" envelope. If a student runs out of money before the end of the game he may borrow from his "me" envelope to pay the "utility bill."

4. At the end of the game, count the money in each envelope to show the students how much their energy habits are costing them. Discuss how students could get more in their "me" envelopes.

Taking it a Step Further

How much the student learns from this depends on you. If you quickly discuss the "whys" of the questions with the students they will have a better understanding of how to change their energy practices. Stress to the students that this is a game for them to see how much extra energy they really use, so it is best if they answer the questions honestly.
Utility companies produce good pamphlets with energy saving tips. You could get copies for your students to take home as a follow-up to this activity.

THE PAY ME GAME QUESTIONS

QUESTION: Do you have an electric blanket?
YES: pay UTILITY envelope $2
NO: pay your ME envelope $2
(Electric blankets cost about 8 cents a night or $2.40 a month per person. Using warm pajamas and blankets save the most energy. But if your room is still too cold at night it cost less to use an electric blanket than to heat up the whole room.)

QUESTION: Have your parents ever heated the kitchen with the stove or oven?
YES: pay UTILITY envelope $10
NO: pay ME envelope $10
(If you ever see someone doing this you should tell them that is dangerous, expensive and doesn't work very well.)

QUESTION: Do you have air conditioning for your entire house?
YES: pay UTILITY $45
NO: pay ME $20
(A mid-size air conditioner costs about 16 cents an hour to operate. You can save money on air conditioning if you keep windows and doors closed during the heat of the day. At night you can turn off the air conditioner, open the doors and windows and turn on fans to get cool outdoor air into the house. Be sure to close the house back up before it gets warm the following day.)

QUESTION: Do you have a window air conditioner for one room?
YES: pay UTILITY $20
NO: pay ME $20
(Cooling only one room or area of your house costs much less than cooling the entire house. Keep the doors closed to unused rooms.)

QUESTION: Do you take baths in the bathtub?
YES: pay UTILITY $6
(A bath takes at least 15 gallons of hot water; that's at least 10 cents a bath. In a month that's $3 per person.)

QUESTION: Do you take showers that are less than 5 minutes long?
YES: pay ME $5
(A shower that is less than 5 minutes will use less than 6 cents of hot water.)

QUESTION: How many members of your family take showers that are more than 5 minutes long?
Pay UTILITY: $5 for each person in your family who does this

QUESTION: Do you always, always turn off the lights before leaving a room?
YES: pay ME $5
NO: pay UTILITY $5
(An average electric bill for lights alone is $9 a month.)

QUESTION: Are your clothes dried in a clothes dryer?
YES: pay UTILITY $13
NO: pay ME $13
(It costs about 80 cents an hour to operate. This can get very expensive after a few loads of clothes. Cleaning the filters after each load is dried and drying one load after another so the drum doesn't have to be re-heated for each load will save money.)

QUESTION: Do you sleep in a waterbed?
YES: pay UTILITY $20
(Keep the waterbed below 85 and keep the mattress covered at all times to save money. There are special electric blankets that you can put on top of your waterbed, which keeps you warm without having to heat up all the water. These electric blankets can save a lot of money.)

QUESTION: In the summer are the drapes in you home closed to keep out the heat?
YES: pay ME $10
NO: pay UTILITY $5
(Closing drapes and putting up shades keeps the sun and warm air from getting into your house, which keeps your house much cooler. Students will probably be familiar with how light coming through a window can heat up a car on a hot day. A house with direct sunlight coming in heats up the same way.)

QUESTION: Do you use a dishwasher to wash your dishes, without opening the dishwasher door to dry the dishes?
YES: pay UTTLITY $5
NO: pay ME $3
(If you turn the drying cycle off and open the door to let the dishes dry you can pay yourself $2.)

QUESTION: Do you have more than one refrigerator or freezer at your house?
YES: pay UTILITY $12 for a second refrigerator or freezer
(Each extra refrigerator costs about $12 a month, that's $144 a year!)

QUESTION: Is your refrigerator opened more than 6 times a day?
YES: pay UTILITY $2 for each person who opens the door
NO: pay ME $5
(It costs about 3 cents every time the door is opened.)

QUESTION: Do you use a hairdryer?
YES: pay UTILITY $3
NO: pay ME $3
(It costs about 8 cents every time you use a hair dryer.)

QUESTION: Do you listen to the radio or watch videos on a VCR?
YES: pay UTILITY $2
NO: pay ME $1
(It costs the average household about $2.30 a month to use these.)

QUESTION: Do you play video games?
YES: pay UTILITY $4
NO: pay ME $2
(Even though most video games are electronic and use a small amount of electricity usuall they are played for many hours and the electricity adds up.)

QUESTION: Do you have an electric toothbrush?
YES: pay UTILITY $1

QUESTION: Do you have a swimming pool?
YES: pay UTILITY $20
(Pools are expensive to operate, especially if you heat them. The pool filter alone costs abo 10 cents an hour to operate.)

QUESTION: Do you have an electric clock?
YES: pay UTILITY $1
NO: pay ME $1
(A wind-up clock doesn't use electricity.)

QUESTION: Do you have an electric can opener?
YES: pay UTILITY $1
NO: pay ME $1
(A good hand-operated opener works well for most people.)

QUESTION: Do you use a portable electric heater on the winter?
YES: pay UTILITY $30
NO: pay ME $10
(In general, portable heaters are one of the least efficient heating sources. If you're the onl one who's cold consider putting on an extra sweater or socks instead of using the heater t warm up your room.)

QUESTION: Does your freezer have an automatic ice maker?
YES: pay UTILITY $3
(It is cheaper to make ice cubes with ice cube trays in your freezer.)

CONCLUSION:
Add up the money in each envelope, don't count any money that is in your hand. Ask: Wh has the most money in their "ME" envelope? Who has the most money in their "UTILITY envelope? Discuss how students could get more in their "ME" envelope. (Use the information provided with the questions.)

If this was real money, and students could get any money that they could save, what would they do?

Activity: Meter Reading

Lesson plan also available online at: http://www.ase.org/educators/lessons/meter.pdf

Objectives: Students will learn to read utility meters and compute energy use.
Summary: After learning to read gas and electrical meters, students will then proceed to monitor the energy used in their homes and keep a daily record. At school the information will be compiled and discussed.
Grouping: Groups of four or individuals.
Time: 30 to 50 minutes for initial lesson; then 20 minutes per day over one week or more.
Subjects: Math, science.
Vocabulary: Kilowatts, cubic feet
Materials:

- Meter-reading practice sheet
- Home meter worksheet

Preparation & Background

Make copies of the worksheets; one of each for each student. Meter reading can be kind of tricky. It helps to remember these rules:
+ The dials are like watch faces. BUT every other dial moves counter-clockwise.
+ Always read the faces from left to right.
+ If the pointer is between two numbers, always record the number it has just passed (this is the smaller number, except when passing from 9 to 0: the 0 represents a 10 in this case).
+ If the pointer seems to be pointing directly at the number, refer to the dial on the right. If the hand on the dial to the right has recently passed zero, then you should put down the number that the other hand seems to be pointing at. If the dial on the right is short of zero, put down the next lower number. (Meters needles are not always positioned precisely. they may appear to have reached a number before it is appropriate.)

Use the practice meter reading sheet and look at the examples awhile. These rules actually make sense when you see that each of the dial faces represent a ones, tens, hundreds, thousands and ten-thousands column.
Note: Some meters are marked with a x10 or x20. These meter readings should be multiplied by 10 and 20 respectively.

Procedure:

1. Go over some energy bills from home so students understand how to read them.

2. Teach the class to read meters (review the preparation and background section if necessary).

3. Next assign them to groups of 4 or *5,* and practice using the sample worksheet. They can do the examples "round robin" style; one student or group does a problem then the next student or group checks it and does the next example. This continues through the groups.

4. When they seem to be getting the drift of it, distribute the home energy-use sheets. Explain to students how they will be checking their gas and electricity meters at home daily. They will compute a total for both cubic feet of gas and kilowatt-hours. If possible, it

would be interesting to have one student do the school meters.

5. Each day in class, you can take a few minutes co see if anyone has had any problems At the end of the week, everyone can see how much electricity and gas their family has used.

Answers for worksheet:
1. 18192
2. 62579
3. 62606
4. 9486
5. 2620
6. 8702

For Discussion:
1. Does your family spend more money on gas or electricity?
2. Can you think of five ways to use less gas and electricity?
3. Where does your gas and electricity come from?
4. How much gas and electricity did the families of the whole class use in a week? A year?
5. How much gas and electricity did the families of the whole school use?

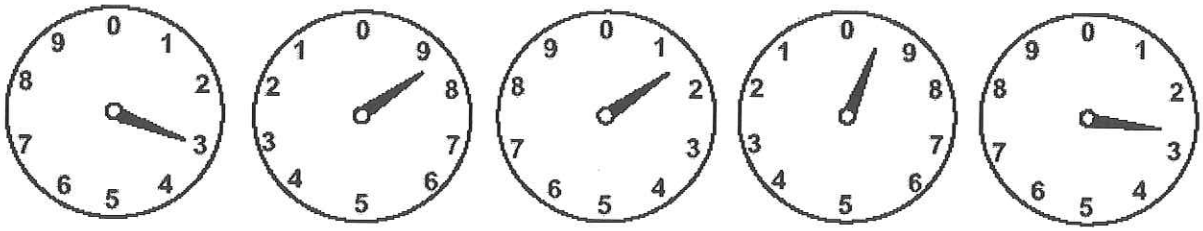
Extensions:
- You can do a spelling bee activity with meter reading: set up a few dials on the board a change the arrows for each player.
- Lengthy discussions can develop around the energy use in different homes. A before-a after study can be done, incorporating energy-saving techniques in the household and computing savings afterwards. Students can compare the type of appliances they have t the amount of energy they use.
- Week-long samples can be done at different times of year and compared. This illustrate where energy use is highest, usually when heating or air conditioning are used.
- Chart or graph a year's worth of your own energy bills and present them to your class. Discuss with students the possible reasons for the fluctuations.

METER READING WORKSHEET

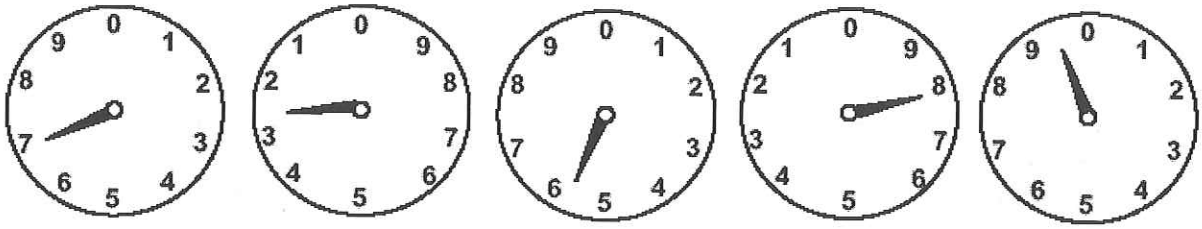
Name_____

Read the following meters and write your answer in the space below each dial face.

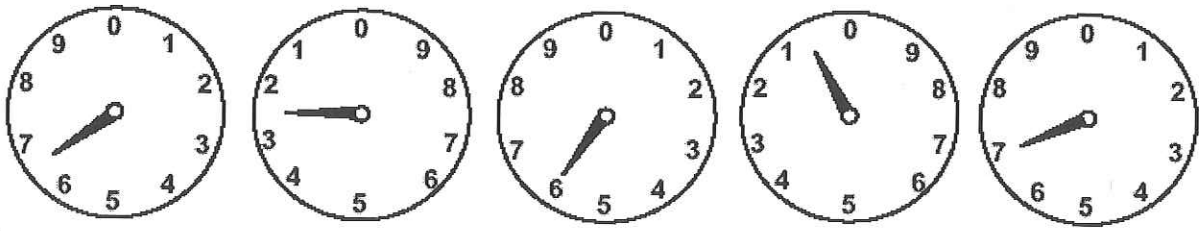
Electric Meters

1. 

_____ _____ _____ _____ _____

2. 

_____ _____ _____ _____ _____

3. 

_____ _____ _____ _____ _____

Energy Conservation

Wasting Energy At Home?

Lesson plan also available online at: http://www.ase.org/educators/lessons/wasting.pdf

Objectives

The student will do the following:
1. Write a definition for conservation.
2. Identify ways energy is wasted.
3. List ways to conserve energy in the home.
4. Categorize home appliances as heavy, moderate, or light users of energy.

Subject: Science
Time: 45 minutes, plus take home activity
Materials: Crayons or colored markers, teacher sheet (included), student sheet (included)

Background Information

We use more energy each year than we used the previous year. In fact, during the 20th century, the amount of energy our Nation uses has doubled about every 20 years. We used twice as much energy in 1955 as in 1935 and nearly twice as much in 1980 as in 1960. The rates of increase in our energy consumption have slowed somewhat, but we continue to use more and more energy.

Energy conservation—the wise and efficient use of energy—was not thought of before the energy crisis of the 1970s. When a shortfall in imported oil shipments and a dramatic rise in oil prices caused energy costs to skyrocket, we became concerned about saving energy. Today, energy costs have stabilized and the economy is stronger, but we still need to think about and practice energy conservation. Not only does energy conservation save us money on our energy bills now; it saves us (and consumers in the future) money in the long run by making our irreplaceable energy resources last longer.

Today's students are tomorrow's consumers. Developing energy conservation skills will serve them well in the future, when prices are certain to be higher than they are now. Additionally, students may be able to help their families conserve energy at home, benefiting themselves and others both now and in the future.

Terms

Appliance: an instrument or device designed for household use especially operated by electricity.
Conservation: the wise and efficient use of resources (e.g., energy resources).
Energy: the ability to do work.

Procedure

I. Setting the stage

A. Define energy conservation and share the background information as appropriate.

B. Give each student a copy of the student sheet "WASTING ENERGY," included.

1. Have the students draw an "x" on the ways energy is being wasted.
2. Ask the students, "How can energy be conserved in this picture?" (turn off lights, turn off TV, close door; some students may suggest covering the window and/or carpeting the floor).

3. Have the students list examples of how energy is conserved in their homes.

II. Activity

A. Give each student a copy of the student sheet "HOW TO CONSERVE ENERGY IN YOUR HOME" (Included on page 33). Discuss the directions with the students. Have the students take the sheet home and complete it with the help of their parents.

B. Have the students identify energy users and wasters in their homes.

1. Give each student a copy of the student sheet "HOME ENERGY SURVEY" (Included on page 32).

2. Make a transparency of the teacher information sheet "APPLIANCE ENERGY USE" (Included on page 34). Have the students list the home appliances pictured on the student sheet ("HOME ENERGY SURVEY") and given on the transparency. Put the following headings on the board and divide the listed appliances into these categories—"Heavy Users of Energy," "Moderate Users of Energy," and "Light Users of Energy."

3. Discuss with the students which appliances shown on the "HOME ENERGY SURVEY" student sheet they have in their own homes.

4. Have the students circle in red the depicted energy wasters found in their own homes.

III. Follow-up

A. Have the students write a definition (in his/her own words) of conservation.

B. Have the students list five ways to conserve energy in the home.

C. Have the students make a chart (similar to the one below) based on the information they marked on their "HOME ENERGY SURVEY" student sheets. An example is given below:

Energy Users

1. Television, lights radio, phonograph
2. Range (stove)
3. Washer
4. Car
5. Bath
6. Outside doors
7. Thermostat
8. Fireplace
9. Windows
10. Appliances

Ways to Reduce Energy Use

1. Turn off when you are not using.
2. Cover pots; thaw frozen foods before cooking; plan meals carefully.
3. Wash full loads; use cold water.
4. Walk; ride in carpools; ride a bike; observe speed limits; keep car in good running condition.
5. Short shower instead of deep bath; take shorter shower or shallower bath (use less hot water).

6. Install storm doors; keep doors closed when using heat or air conditioning; install weatherstripping.
7. Set at 68 degrees in winter and turn down at night; wear warm clothes; set at 78 degrees in summer; wear cool clothes.
8. Close flue when not in use; install glass fire screen that can be closed when fireplace is not in use.
9. Close draperies at night; put shutters, blinds, or drapes on all windows; install storm windows; install weatherstripping.
10. Do not use several heavy users at the same time; turn off appliances when not in use.

IV. Extension

A. Invite a speaker from your local power distributor to speak to the class about ways to conserve energy.

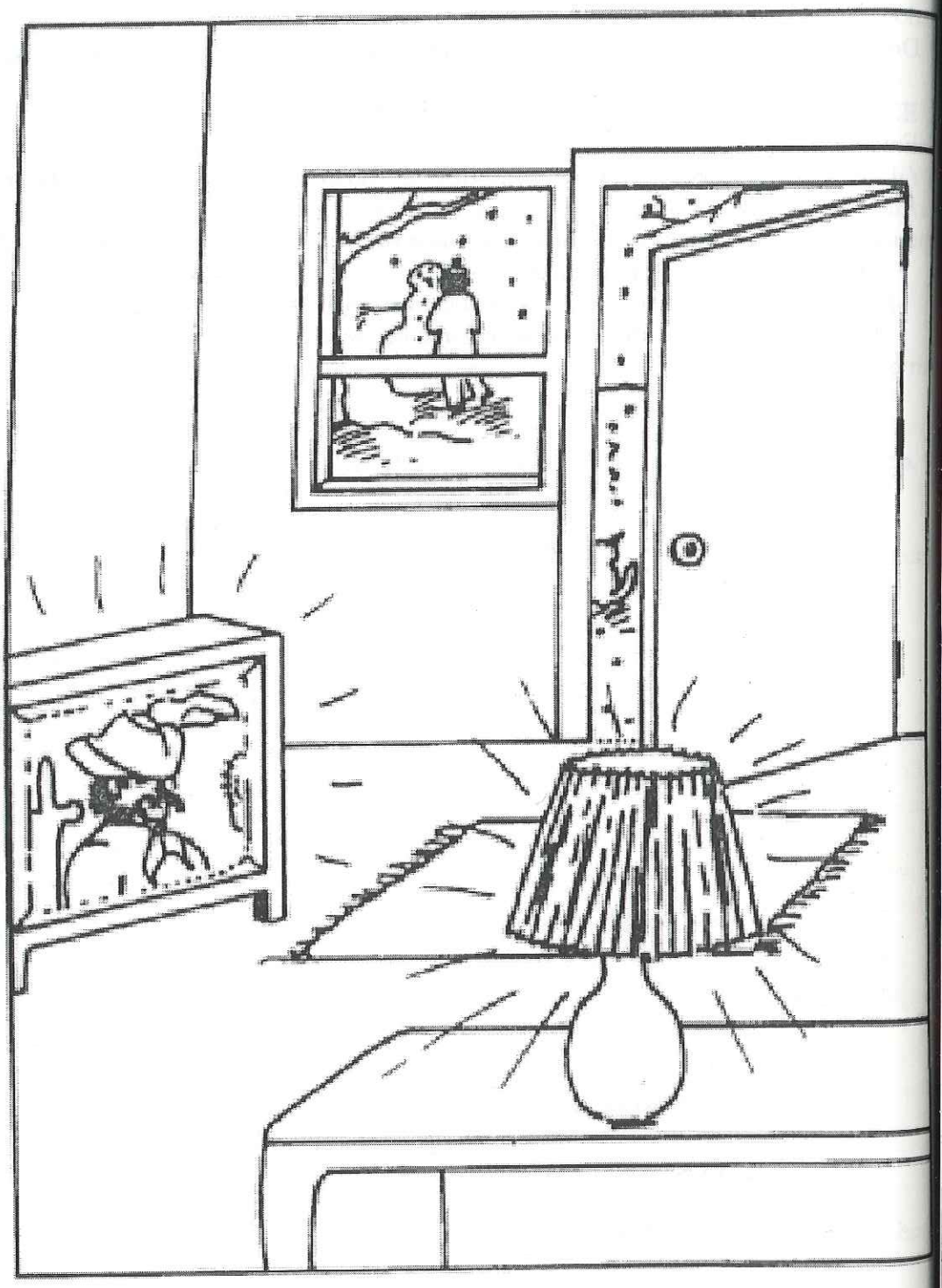
B. Have the students, with the help of their parents, compare several months utility bills and discuss ways to conserve electricity.

C. Have the students project what will happen to electrical costs by the year 2010, then write and perform a skit showing a family receiving and paying an electric bill in that year.

WASTING ENERGY

Name_____

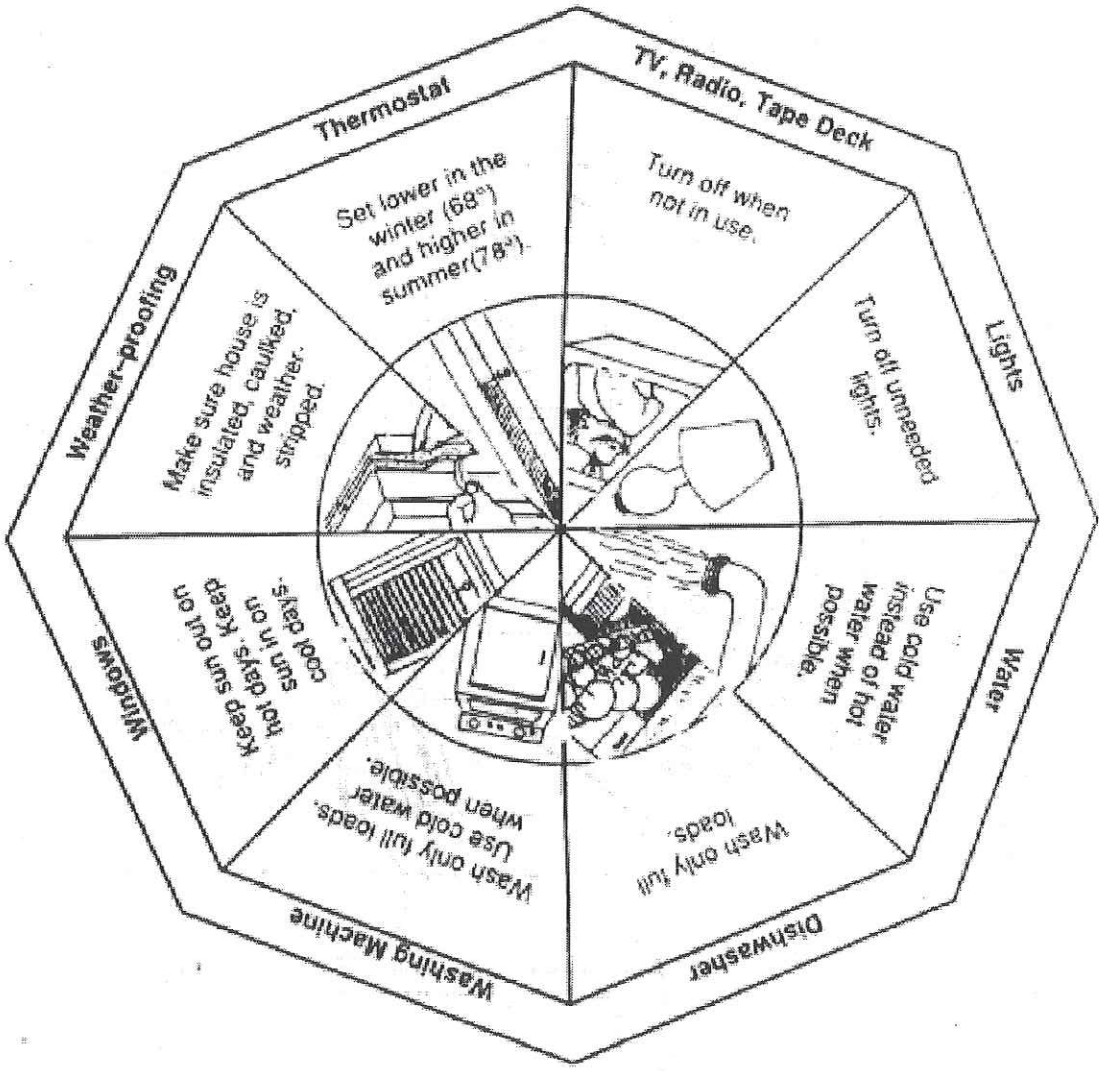
Put an "X" on all the ways you observe energy being wasted.



HOW TO CONSERVE ENERGY IN YOUR HOME

Name_____

Directions: Read each triangular shape. Color the triangular shape light blue if you and your family observe the energy conservation rule. Color the triangular shape yellow if you and your family do not observe the energy conservation rule. Discuss with your family ways to save energy in your home.



APPLIANCE ENERGY USE

Name_____

Appliance	Average kWh Used	
	Annually	Monthly
Kitchen		
Range w/self-cleaning oven	1,224	102
Range w/oven	1,152	96
Microwave Oven	300	25
Frying pan	190	16
Coffee maker	110	9
Toaster	40	3
Mixer	10	1
Food disposer	30	3
Dishwasher	1,560**	130
Refrigerator/Freezer 16-25 cu ft side-by-side model, auto defrost	2,160	180
Refrigerator/Freezer 14 cu ft, auto defrost	1,800	150
Refrigerator/Freezer 14 cu ft, manual defrost	1,200	100
Refrigerator/Freezer 17 cu ft, two-door, high efficiency, auto defrost	1,200	100
Freezer, 15 cu ft, auto defrost	1,800	150
Freezer, 15 cu ft, manual defrost	1,200	100
Laundry		
Clothes Dryer	1,000	83
Clothes Washer	624***	52
Hand Iron	150	13
Entertainment		
Color TV		
Tube Type	660	55
Solid State	440	37

B&W TV		
Tube Type	350	29
Solid State	120	10
Radio/phonograph	110	9
Comfort		
Electric Furnace	13,200*****	(seasonal)
Heat Pump	6,600****	(seasonal)
Air Conditioning, central, per ton	1,500*****	(seasonal)
Air Conditioning, room, 1 ton	1,500	(seasonal)
Dehumidifier	400	33
Electric Blanket	150	(seasonal)
Attic Fan	300	(seasonal)
Ceiling Fan	130*	(seasonal)
Other		
Quick Recovery Water Heater	4,200	350
Vacuum Cleaner	50	4
Clock	18	1.5
Toothbrush	0.5	0.04

*These figures are averages and will vary depending on user habits and lifestyles.
**Includes kWh for heating water used by appliance.
***Based on warn water wash and cold water rinse.
****Heat only.
*****Based on 1,500 square foot house insulated to meet TVA standards for energy efficiency. If your house does not meet these standards it may use considerably more electricity during the heating and cooling seasons.

Credit: "The Energy Sourcebook: Elementary Unit" (1990) Tenessee Valley Authority.

Conserving Energy at School

Lesson plan also available online at:
http://www.ase.org/educators/lessons/ConservingSchool.html

Objectives: The student will do the following:
1. Identity ways the school is wasting and conserving energy.
2. Suggest how the school can conserve more energy in the future.

Subject: Science
Time: 90-135 minutes
Materials:

- Teacher sheet (included on page 39)
- Student sheet (included on page 40)

Background Information

Schools use a tremendous amount of electricity. This is particularly true for those that are electrically heated and cooled. (Just think of the large area that must be heated or cooled.) Lighting is another major user. When all the electrical appliances and equipment necessary for day-to-day operations of a modern school are considered, it is easy to understand the increasing dependence of schools on electricity, even though electricity is a major budget item. Some schools have monthly electrical bills of thousands of dollars.

Some newer school buildings are energy-efficient, but many of schools are older and are not energy-efficient. Energy-saving buildings not only use less energy than wasteful buildings, but they are more comfortable.

Some key things in efforts to conserve energy at school are thermostat placement and setting, control of lighting, air vent location, and the number and operation of windows and exterior doors. Thermostats should be located on interior (rather than exterior) walls. They should be set on 68 degrees during the winter and 78 degrees during summer. Unused lighting should be turned off. Furniture arrangement should not block the flow of heated or cooled air from vents. Excessive windows and exterior doors are energy wasters, as are those that are too-often opened (while the building is being heated or cooled) or those that are left open. Of course, all unused electrical equipment and appliances should be turned off, but these are minor contributors to school energy bills when compared to heating, cooling, and lighting.

You may be interested in learning more about the Alliance to Save Energy's Green Schools Project. The Green Schools Project has two primary purposes: 1) to bring some financial relief to schools; 2) to educate students, teachers, facilities and maintenance staff, administrators, and the whole school community about energy efficiency, its ties to the environment and the fiscal health of schools. Visit http://www.ase.org/greenschools/ for more information on the Green Schools Project.

Procedure

I. Setting the stage

A. Share the background information, as appropriate, with the students, defining terms as necessary.

B. Prepare beforehand a transparency made from the teacher sheet "WHICH CLASSROOM IS CONSERVING" included (on page 39). Show the transparency to the students and explain its diagrams.

1. Ask the students the following question:

a. Which classroom do you think is conserving energy? Why? (Classroom 1 thermostat is on inside wall, the room has only two windows, and heating vent not blocked)

b. Why is the other classroom wasting energy? (too many windows, thermostat on outside wall, and heating vent blocked by desks)

c. What can be done to make Classroom 2 more energy-efficient? (cover up some windows, rearrange desks so heating vent is not blocked)

d. Can you think of some other ways to conserve energy at school that are not shown on the diagram? (some possible answers include keeping heating units & filters clean; turning off lights, heating/cooling, and appliances when not needed; setting the thermostats correctly; and so on)

2. Discuss with the students why it is important to conserve energy at school. (Some points to discuss include the expense of energy and the need to stretch our remaining supplies of conventional energy resources.)

II. Activity

A. Have the students conduct a school energy survey.

1. Make or obtain a drawing of the schools layout. Divide the school into zones.

2. Divide the students into groups and assign a zone to each group of students.

3. Give each student a copy of the student sheet "IS ENERGY CONSERVED OR WASTED IN YOUR SCHOOL?" (included on page 40). Discuss the eight items on the worksheet. Tell the students that if they observe energy being conserved in an area listed on the worksheet, they are to write a "1" in the blank beside "conserved." If they observe energy being wasted, they are to write a '1 in the blank beside "wasted." (This is assigning points for energy conservation or waste.)

4. Have the students conduct the survey.

B. When all of the eight items listed on the worksheet have been observed/recorded for each zone, have the students total the points they assigned and be ready to discuss the results of this survey.

III. Follow-up

A. Have the students explain to the class what they found in their zones.

B. Ask the students the following questions:

1. Do you think our school can conserve more energy? How? (Possible answers include— turn off unnecessary lights; keep furniture from blocking heating/cooling vents; keep exterior doors closed in winter; keep heating/air conditioner filters cleaned; remodel the building to add carpet, decrease number of windows, lower ceilings, and place thermostats on inside walls.)

2. What can you do to help conserve energy at school? (Possible answers include— wear warm clothes in winter and cool clothes in summer, keep windows and doors closed when heat or air-conditioning are on; and keep unnecessary lights turned off

C. Plan and organize an "Energy Week" for your school. Each grade level will be responsible for completing one of the energy conservation activities listed below:

1. Third Grade: Have the students draw pictures and write short paragraphs on energy conservation for a bulletin board display.

2. Fourth Grade: Have the students create and present a short skit on energy conservation.

3. Fifth Grade: Have the students help coordinate Energy Week. Have them "brainstorm" ideas about energy conservation and then compile their ideas into a presentation. Let some of the students visit other classes and do their presentations.

IV. Extension

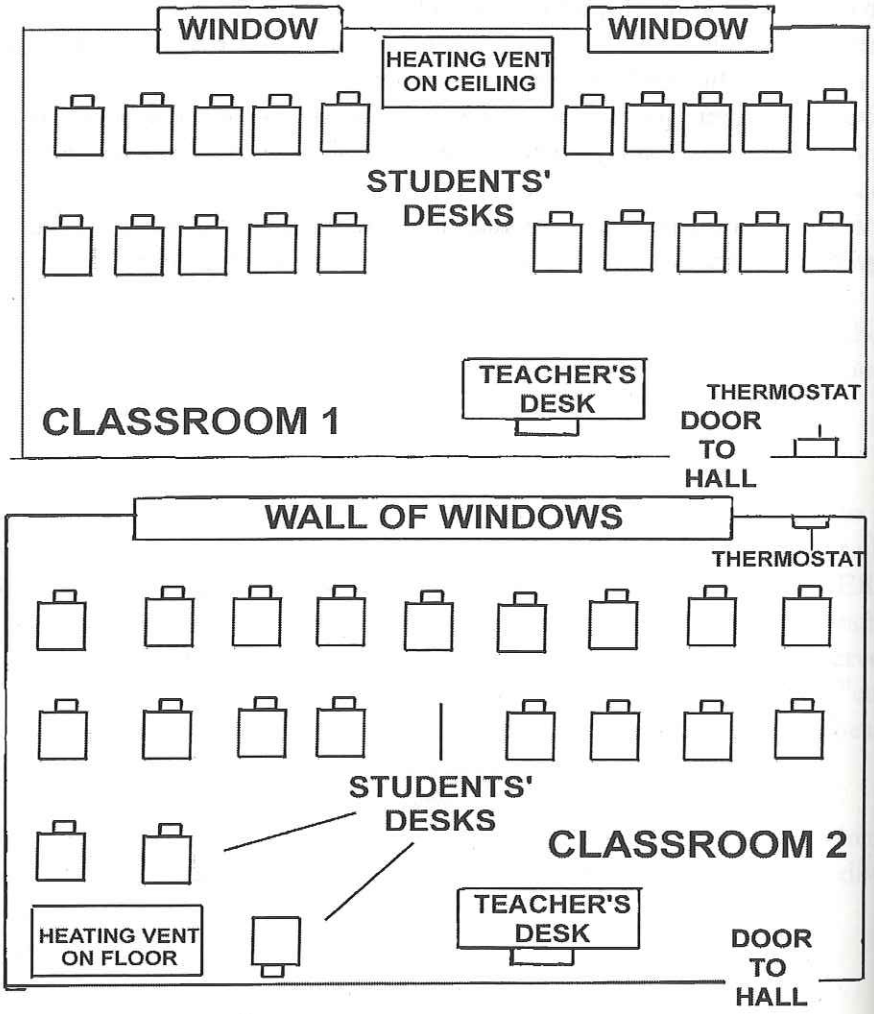
A. Have the students draw pictures of buildings designed to conserve energy. (Some features might be few windows on the north side, brick structure, and landscaping such as tall shrubs on the north side of the structure.)

B. Have the students start a "Let's Energize" campaign for the school. Have a school-wide poster contest. Display posters recommending good energy practices for the school.

C. Have an assembly program in which the students may share the activities from Energy Week. Activities might also be shared at a parent/teacher organization meeting.

WHICH CLASSROOM IS CONSERVING ENERGY?

Name_____



IS ENERGY CONSERVED OR WASTED IN YOUR SCHOOL?

Name_____

Tour your school building to look for ways energy is conserved or wasted. There are eight things to observe as you walk through the building. If you think energy is being conserved, write the number "1" in the "conserved" blank. If you think energy is being wasted, write "1" in the "wasted" blank. Repeat this process in every room you check. When you finish your tour, count the points for each thing. Does your school save energy or waste energy?

Thermostat (Should be located on inside walls and set at 68 deg. F. in winter or 78 deg. F. in summer.) Conserved: Wasted:	**Floor Covering** (Capreting helps keep rooms more comfortable.) Conserved: Wasted:
Ceiling Height (About 8 feet is average. Very high ceilings waste energy.) Conserved: Wasted:	**Windows** (Check for drafts and for numbers of windows.) Conserved: Wasted:
Classroom Air Vent Filters (Clean filters conserve energy. Dirty filters waste energy.) Conserved: Wasted:	**Lighting** (Unnecessary lights should be turned off.) Conserved: Wasted:
Exterior Doorways (Doors should be kept closed when heat or air conditioning is on.) Conserved: Wasted:	**Furniture Placement** (Furniture should not block heating or cooling vents.) Conserved: Wasted:
Total Points: Conserved: Wasted:	

Activity: Energy Patrol

A Step by Step Guide to Setting up a School-Wide Energy Patrol

Guide also available online at: http://www.energy.ca.gov/education/patrol/index.html

For the cost of four t-shirts, jackets or hats, your school could save as much as $1,000 a month.

How? By beginning a student Energy Patrol.
Energy patrols are one of the most popular and effective energy action programs to be developed in California.

Students on energy patrols monitor classrooms to ensure that lights are turned off when rooms are vacant, which reduces school electrical costs considerably.

Lighting is a good target for any school energy program because in most schools, lighting is the largest energy-user, consuming from 38 percent to 54 percent of total classroom energy.

The **Energy Patrol** originated at DeVargas School in the Cupertino Unified School District near San Jose, California. The patrol gives students an opportunity to practice leadership skills by taking responsibility for their school. By getting kids actively involved, the program makes the school a more exciting learning environment, and at the same time can reduce the school's energy costs by roughly 1/3 or $1,000 a month in DeVargas's case. That money can be used for other school programs.

The Energy Patrol was so successful that it was adapted at every elementary school in Cupertino and their efforts were recognized nationally with a U.S. Department of Energy Award for Energy Innovation. The Energy Patrol has been adapted by many schools across California and the nation for kids as young as second grade and as old as junior high. It probably works best for upper elementary. The name may change to Waterford Watt Watchers or something that reflects the school mascot, but the result is the same.
One thing that is important not to omit is special recognition for the students. That's where t-shirts, jackets or hats come in. Special jackets with the school name and energy patrol symbol would spark student interest and give them the recognition they deserved. In Cupertino, the district paid for the jackets or you can ask your local utility, school PTA, booster club or business community to contribute. Tracking your success is also important to see if your patrol is saving 20 to 30 percent of the school's energy bills.

The following is a packet of materials, including check sheets and procedures, developed by DeVargas School which describe the details of how they began, and still operate their energy patrol program. If your district does not currently track energy costs, you may want to contact your local utility for more information on how to track the savings from the Energy Patrol.

THE DEVARGAS SCHOOL CASE

A DeVargas teacher tells how...

The DeVargas School Energy Patrol has saved our school district thousands of dollars! Sound too good to be true? After a $1,000 savings the first month, we, too, thought that something must be wrong. But each month as the utility bills came in the results continued to be fantastic.

The DeVargas Energy Patrol is made up of 20 students in the fourth, fifth and sixth grades. Teams of these students check each classroom, the office areas, portables, and store rooms at recess, lunch, and after school.

When lights are found on, they are quickly turned off. Periodically, thermostats are also checked.

Patrol requires little teacher involvement

When the principal at DeVargas School got the idea for the Energy Patrol, he realized there needed to be something special about the group to attract and motivate fourth, fifth and sixth graders. He went to the Cupertino School District's associate superintendent for business and asked for $100 for Energy Patrol start-up expenses. In exchange for the money he promised that the school would save $100 on their utility bills. With the funds, he purchased four jackets that say "DeVargas School Energy Patrol" on the front and have the patrol's symbol, the lightning bolt, on the back. He also got photo ID tags for each energy patrol member. Members wear a jacket and their name tag when they are on duty.

Teachers were asked to recommend responsible students for the program who could be trusted with keys to the buildings and would need little supervision. There is no other teacher-involvement otherthan enthusiastic support of the program. Administrative involvement after initial start-up is minimal.

Simple daily routine saves dollars

Four students are on duty each day. One team of two students checks half the rooms and a second team checks the other half. It now takes them about five minutes. The students come to the office where their jackets, name tags and clipboards are kept in one corner of the store room. They get into uniform and pick up the keys, which are kept near the secretary's desk in a secret hiding place known only to Energy Patrol members. They do their rounds, keep records of whose lights are on or off, put up reminder notices on light switches, bring back their materials and go to recess. It's easy and quick!

Students create light switch reminders

Activities for the Energy Patrol have gone beyond the original plan. Anxious to do more to save energy, the students asked if they could explore other energy problems and expand their duties. They created bulletin boards on conservation, put "Save Energy" signs by every light

switch, visited their local utility to hear suggestions for conservation, performed an air flow study and sent the results to the District Office.

The results of that study led to many new thermostats and some improvements to the heating system. The students made a School Board presentation and even appeared on a local television news program.

One of the activities, beyond turning off lights, that most directly saved energy was creating a reminder that says, "Oops, you forgot to turn off your lights." That 3" x 3" piece of paper with the picture of an unhappy lion (the lion is the DeVargas School mascot) is taped over the light switches that are left on in unused rooms. Eight will fit on one page, which were then run off on a copier and cut apart.

These reminders have increased the awareness of students and staff. Nobody wants an unhappy lion to remind them that they are not helping in conservation efforts. Conservation reminders (used to remind people of the right thermostat settings) are made the same way, but the students color them carefully and then laminate them.

Kids can make a difference!

Awards are presented at assemblies to classes that have done a good job of turning off their own lights. The basic activity, though, of getting lights turned off at recess and lunch and after school, and encouraging other students and teachers to do the same, is still the job of the Energy Patrol and all that's really necessary for success.

Did DeVargas School save $100 the first month? That, and more!
They averaged a savings of more than **$1,000 a month for every month the patrol worked** -- or a total savings for one school year of $8,000. That was one-third of the school's energy bill! Kids can make a difference!

Note:
The model provided by DeVargas School can be adapted to meet your school's special requirements. In some schools, light switch reminders have been designed to fit on door handles.

Some schools hold competitions to design reminders so all students can be involved. In some schools, staff members have not been comfortable giving even the most responsible students access to a master key, so strategies other than reminders taped to light switches have been used to notify staff that lights were left on.

The program may also change over time. It's common after several months of operating an energy patrol to find that lights are almost never left on. If this happens, patrols often change their schedules so surprise spot checks are made once or twice a week or month. Patrols can also take on new tasks such as checking to see that shades are opened and closed at the proper times or checking thermostat settings to see that they are appropriately set.

Energy Patrol Start-up Procedures

1. Obtain support from your District Office.
Responsibility: PRINCIPAL

2. Hold staff meeting to present Energy Patrol idea.
Responsibility: PRINCIPAL

- Rough overview of Patrol activities.
1. Entering classroom unsupervised.
2. Record keeping.
3. Reporting to students, etc.
- Generate staff support and enthusiasm.

3. Develop list of possible Energy Patrol members.
Responsibility: TEACHERS

4. Evaluate list and make final choices.
Responsibility: PRINCIPAL/ADVISER

5. Meet with students and explain general procedures for Energy Patrol.
Responsibility: PRINCIPAL/ADVISER

6. Develop procedures and materials.
Responsibility: STUDENTS/ADVISER

- Rules, regulations and agreements.
- Check sheets for each room.
- Location of supplies.
- Schedule of inspections.
- Draw and ditto light switch reminders.

7. Have students sign agreement to serve as Energy Patrol Members. Keep agreements on file.
Responsibility: STUDENTS/ADVISERS

8. Walk through with all members -- noting locations of light switches and thermostats, etc.
Responsibility: STUDENTS/ADVISERS

9. Publicize starting date and purpose.
Responsibility: PRINCIPAL

- Students.
- Community.
- Staff.

10. Go and save energy!
Responsibility: ENERGY PATROL STUDENTS

Energy Patrol Procedures

1. Get jacket, clipboard, reminder notices and record sheet from the file room. Check for notices of Energy Patrol meetings.
2. Pick up key(s).
3. Inspect your area and record information neatly on the checklist. Re-lock rooms that you enter.
4. Return supplies to their proper area. If you run out of reminder notices, leave a note so more can be run off on the ditto machine.

REMINDER

- **Use of the key is a big responsibility. It can be used by Energy Patrol member only.**
- **Only Energy Patrol members may enter locked areas. Do not bring your friends along or allow desperate students who need snacks, jackets, pencils, books, etc. to enter classrooms!**
- **Members must always wear their jackets and IDs when on duty.**
- **Work quickly -- also, quietly and politely in rooms where people are working.**

Energy Patrol Agreement

NAME _____

GRADE _____

ROOM NUMBER _____

I agree to assume the responsibilities of the (school name) ENERGY PATROL.
I will follow all Energy Patrol procedures and will do the best job possible.

_____
Signed

_____
Date

Sample Energy Patrol Checklist

Building: _____ Month: _____

Location/Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	days etc.
Room 1	/	/	/	/	/	NS	NS	/	/	/	/	/							
Room 2	/	/	0	0	X	NS	NS	/	/	/	/	/							
Room 3	X	X	X	X	X	NS	NS	X	X	X	X	X							
Room 4	0	0	X	0	0	NS	NS	0	X	0	0	X							

Check Which Time:

[X] RECESS

[ ] LUNCH

[ ] AFTER SCHOOL

INSPECTORS:

Monday

Tuesday

Wednesday

Thursday

Friday

KEY:

/	Area in Use
0	Energy in Use/ NO people
X	NO Energy in Use
NS	No School Day

Alternative Energy

Activity: Be "SUN"-sible About Heating Water

Lesson plan also available online at: http://www.ase.org/educators/lessons/besunsible.pdf

Objectives:
The student will do the following:
1. Construct a simple solar water heater.
2. Investigate color and heat.
3. Investigate insulation and heat.

Subjects: Science, Math
Time: 120 minutes
Materials:

- juice cans
- paint (white, black, green, red)
- very hot water
- food colors
- ice cubes
- thermometers
- construction paper (white, black, green, red, blue)
- watch
- quart jars
- cardboard boxes
- newspaper
- glue or rubber cement
- aluminum foil
- razor knife
- clear plastic wrap
- dowel
- duct tape
- tape
- 1-qt. Can
- flat black spray paint
- student sheets (included on pages 50-53)

Background Information

Heating water for use in the home is a major contributor to the home energy bill. One way to reduce energy use by the heater is to turn its thermostat back; settings of 120 to 140 degrees will save energy and still provide water hot enough for all the various purposes for which it is used. Another way to reduce energy consumption by the home water heater is to use less hot water. Cold or warm water performs satisfactorily for typical laundry loads.

One can take shorter showers or shallower baths. Repairing dripping hot water faucets can save a surprising amount of hot water.

Using the sun's energy is another way to reduce the hot water energy bill. The sun's energy is free, so the cost of solar heated water is less than that of conventionally heated water. Home solar water heaters usually consist of a solar collector, pipes through which water circulates from the collector to the water heater, and a highly efficient water heater similar to a conventional one. The collector, often mounted on the roof, is a dark-colored, glass-faced box in which the sun's heat is trapped. This trapped energy heats the water being pumped through the systems pipes, which pass through the collector. The heated water returns to the water heater, where it is perhaps heated further and is stored for use. The entire system is well insulated, so as to avoid losing heat. Solar water heaters can help lower the high cost of heating water.

Terms:

- Insulation: material that hinders the flow of heat energy.
- Solar collector: any device used to trap the sun's energy and change it into heat energy.

Procedure

I. Setting the stage

A. Have the students consider the energy used to heat Water for home use. Give each student a copy of the student sheet "JONES FAMILY ELECTRICITY USE" (included on page 50). Have the students examine the graph, and discuss with them the questions on the sheet.

B. Share with the class the related information from the background information furnished.

II. Activity

A. Have the students investigate color and heat.

1. Have the students do the activity on the student sheet "WHICH COLOR HOLDS HEAT LONGEST?" (included on page 51).

a. Help the students make graphs and record data as they follow the instructions on the student sheet.

b. Discuss the results with the students.

2. Have the students investigate color and the time required for ice to melt. (Do this yourself as a demonstration or have groups of students do it.)

a. Have squares of construction paper in the following colors—white, black, green, red, and blue. Place an ice cube on each square of colored paper.

b. Time how long it takes for each ice cube to melt.

c. Discuss with the students the results of the investigation.

B. Have the students investigate insulation and solar water heating.

1. Divide the students into groups of three or four each. Give each group a copy of the student sheet "INSULATION REALLY WORKS" (included on page 52), and have the groups complete the activity as instructed.

2. Review the definition of the term "insulation" and relate it to water heating and storage.

C. Have the students build model solar water heaters.

1. Divide the students into groups of three or four each.

2. Distribute the student sheet "HOW TO MAKE A SOLAR WATER HEATER MODEL" (included on page 53) to each group and provide the materials they need.

3. Have them build the model solar water heater models according to the instructions on the sheet.

4. Have the students experiment with different colors or kinds of containers for the water.

III. Follow-up

A. Ask the students the following questions:

1. What are some ways energy is used in the home? (heating, water, air conditioning, appliances, and so on.)

2. What are some ways to reduce the amount of energy used to heat water? (turn water heater thermostat down; use less hot water; repair dripping hot water faucets)

B. Have the students complete the following:

1. Define solar energy.

2. Define insulation.

3. Describe how a solar water heater model works.

C. Ask the students the following questions:

1. How can we use the sun's energy to heat our homes and water? (Heat from the sun can be gathered by solar collectors and stored until needed.)

2. Which reach a higher temperature more quickly when placed in direct sunlight—light-colored or dark-colored objects? (dark)

3. How does a solar collector work? (A solar collector is a box-like device with a glass (or similar material) face and a black interior. It traps and absorbs the energy of the sun's rays. Water piped through the collector is heated and sent to a storage device)

IV. Extension

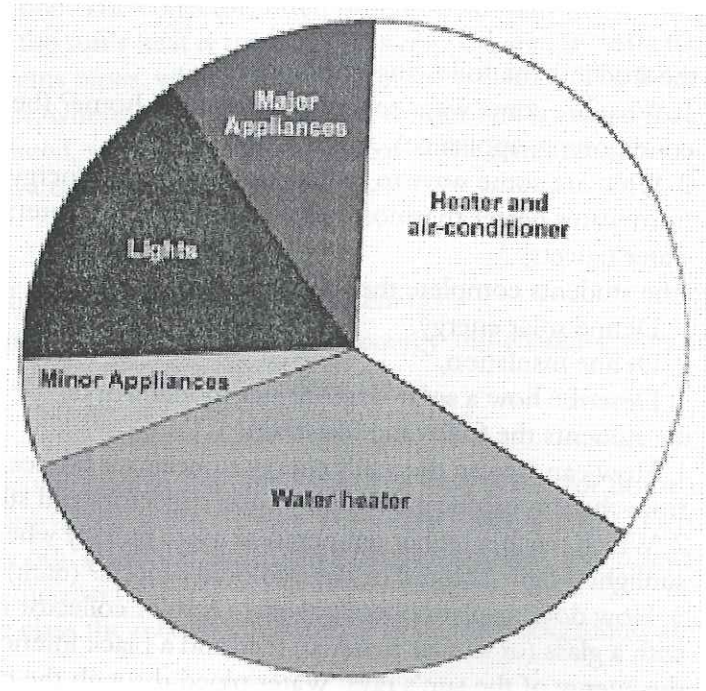
A. Have interested students make posters or a bulletin board of warm and cool fabrics.

B. Have the students write to the U S. Department of Energy's Assistant Secretary for Conservation and Renewable Energy for further information on solar energy (Address: 1000 Independence Avenue, SW, Washington, DC 20585)

C. Invite someone to speak to the class about solar energy.

Jones Family Electricity Use

Name_____



The Jones family made a circle graph to study electricity usage at their house. The graph shows that a large portion of their bill is for heating water.

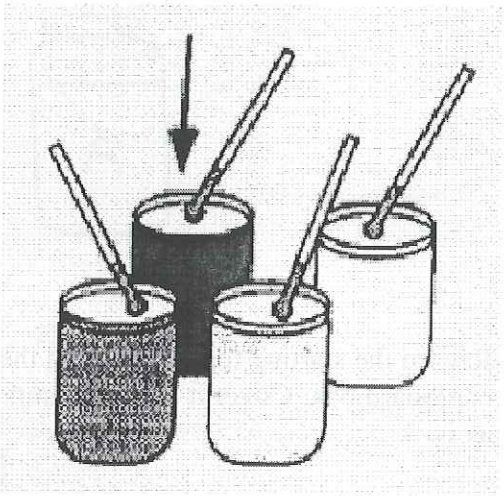
What are some ways the Jones family could decrease their electric bill?

Is there an alternative method for heating water?

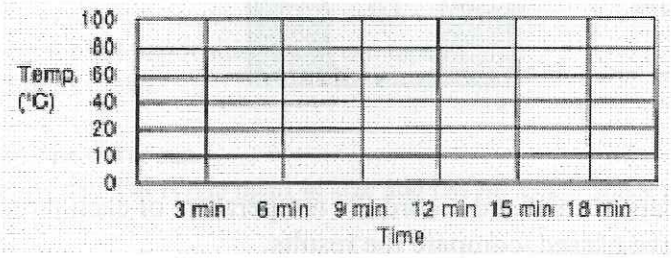
WHICH COLOR HOLDS HEAT LONGEST?

Name_____

Materials: 4 juice cans, 4 colors of paint (white, black, green. and red), very hot water (close to boiling), 4 thermometers, food colors



1. Paint each can a different color.
2. Fill each can with the same amount of hot water.
3. Add food coloring to the hot water; add drops of all the colors together to get black.
4. Put a thermometer in each can.
5. Read and record the temperature every three minutes until the water cools.
6. Make a graph of the results.

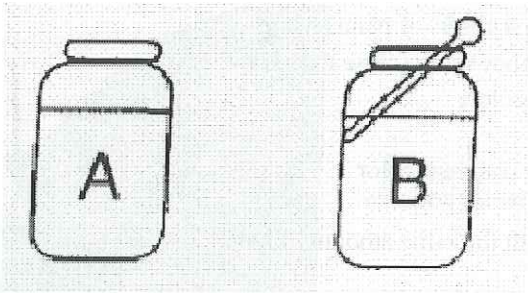


Which color held heat best?_____

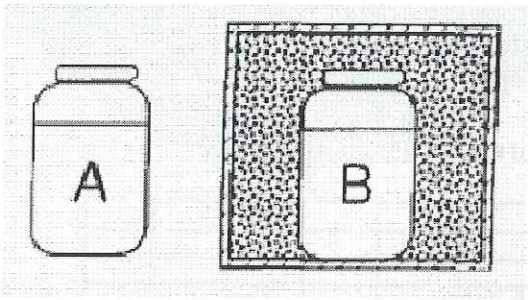
INSULATION REALLY WORKS

Name_____

Fill two one-quart jars with hot tap water and put a thermometer in each jar to measure the temperature of the water.



Record the starting temperature on the chart below. Next, place one of the jars in a cardboard box. Cover it and surround it with shredded newspapers. The other jar remains as is.



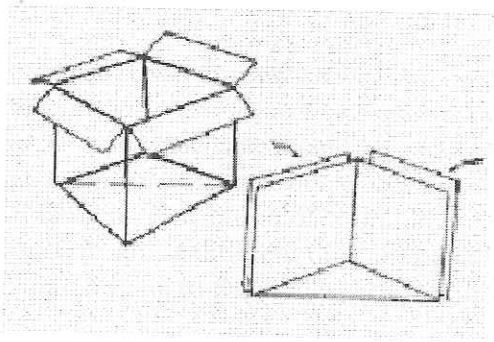
After one of the jars is "insulated,' read and record the temperature of each jar every 10 minutes. After 30 minutes have passed, compare the results.

	Jar A	Jar B
Starting temperature		
After 10 minutes		
After 20 minutes		
After 30 minutes		

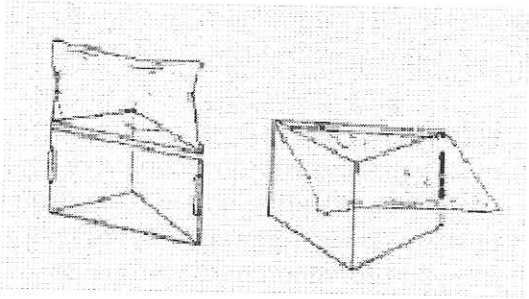
HOW TO MAKE A SOLAR WATER HEATER MODEL

Name_____

1. Cut a cardboard box in half diagonally.
   Cut the box in half along the diagonal as shown, leaving a triangularly shaped top and bottom. Then cut off the top triangle. The leftover piece has two sides that can be cut out to fit flat onto the sides of the remaining box. Then tape them to the sides of the half-box. These side-pieces will add some thickness to the walls and help keep heat inside. Glue aluminum foil to the inside of the box (sides and bottom) with rubber cement (be sure to read the directions on the label).

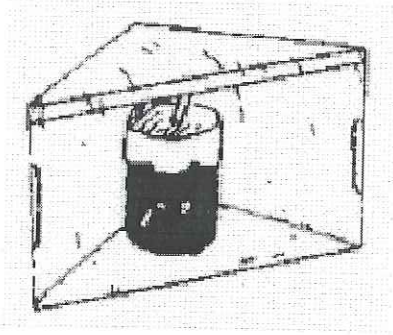


2. Glazing the box.
   Tape a small stick of wood (a dowel) across the top corners of the heater box as a brace. Use silver duct tape. Tape clear plastic wrap to the bottom and sides of the box as shown. Make sure it is long enough to have some left over to fold over the top. The fold-over flap can be used as a door to get into the box. You can tape heavy weights to the corners for holding it shut or you can tape the corners down.



3. Prepare the water can.
   Use any can that is one quart in size and has no leaks. Spray paint it with flat black paint.

4. Set up the water heater.
   Open the top of the heater box. Fill the water can, cover the top of it with clear plastic wrap and put a rubber band around the top of the can to seal it. Place the filled can on the bottom of the heater box and close the top flap. Be sure it is well sealed. Face the front of the box to the south and wait for it to heat up. You can test the temperature of the water by sticking a thermometer into it. You can also experiment with different colors or different kinds of cans and jars.



Sustainable Communities – Comprehensive Program

Created 04/30/00 by: Carol Gentry, Kimberly Jones, Mary Wallis Keller, Dolvin Elementary, Georgia

Lesson plan also available online at:
http://csf.concord.org/esf/Curriculum/Curriculum_DisplayUnit.cfm?ViewID=148

These teacher-created units are designed to actively involve students, use technology as a tool to accomplish specific goals, and to convey the concepts of sustainability through existing curriculum topics. The units vary in depth of content, integration of technology, and use of instructional strategies just as the teacher-authors are at different developmental levels in the art of teaching (teachers range from less than 3 years to nationally certified 25 year veterans).

What would you include in an Earth-Friendly, Sustainable Community?
Overview
This unit provides tasks for students in grades K-2, all subject areas, to focus on the essential question, "What would you include in an "earth-friendly", "sustainable" community?" as it relates to the Education for a Sustainable Future topic of Designing Sustainable Communities. The concept of design is very important in helping us get to a sustainable world. The design of sustainable communities needs to account for environmental and social attributes and is bound by economic reality. Sustainability is bound in the future. We are making choices today about how we live in order to affect the future for our children and grandchildren. This unit will be a study of the components of a community and how they affect its sustainability. We will focus on the role of citizens in helping to make their community earth-friendly thus sustainable.

Through activities such as identifying components of a community and why each one is needed, identifying natural resources and how they're affected by the community, and identifying the location of his/her own community, students will find ways to participate and be responsible citizens in a sustainable community.

Grade Level
K - 2
Curriculum Area
Interdisciplinary
Timeframe
16 - 20 mins; 1020 min Total Estimated Time

Essential Question
What would you include in an "earth-friendly", "sustainable" community?

Subquestions
1. What is a community?

2. Where is my community in the world?
3. What natural resources are affected by our community?
4. What are our civic responsibilities and what can we do about it?

Results
Students will:
-identify the components of a community and why each one is needed.
-identify the location of his/her own community.
-identify natural resources and how they1re affected by the community.
-identify what is needed for a sustainable community of the future.
-identify ways to participate and be a responsible citizen in a sustainable community.

Preparation
-Have students divided into groups of 4-5 for the entire unit.

-Obtain a speaker from a local environmental agency or HSU. Choose a program related to Sustainability issues such as: Recycling: Where Does It Go?, or Treasures From the Earth.

-Kid Pix Studio Deluxe computer program slide show template,

-TV, VCR, Video Camera, Digital Camera, Overhead Projector

-Coloring materials (crayons, markers, Vis-A-Vis pens)

-Access to the computer lab

-The Graph Club computer program (http://www.tomsnyder.com)

-Kids and the Environment: Choices, Choices computer program (http://www.tomsnyder.com)

-Large classroom TV monitor to hook up with the computer

-Bulletin board with maps of the world, the United States, your state, and your local community

-Globe

-Eco-probe

Teaching Procedures
(See http://csf.concord.org/esf/Curriculum/Curriculum_DisplayUnit.cfm?ViewID=148 for the handouts, worksheets, and other underlined items discussed below.)

1.
60 min Preparation: Introduce the Center Suggestions to the students. A sample response from the Science Center is included.
Also make this a school-wide effort by sharing ideas with your staff.
Preparation: Have available large chart paper with 3 sections. One will have written on it K: What We **Know**, the next W: What We **Want** to Know, and the last L: What We Have **Learned**. Homework sheet: What I See in My Community.
Lesson: Read The Little House and discuss. Introduce the KWL chart. Have children respond to the first two sections drawing information from the book and their own experiences. For example, ask the children "What are some things in your community? What were some changes that happened in The Little House?" Explain the homework assignment. The children are to look around their community on their way home, around where they live, and anywhere they go before coming to school the next day. Hopefully they will include types of housing, businesses, transportation and natural resources. They are to draw and/or write about their observations on their homework sheet.
Assessment: 1. Teacher observation of KWL discussion 2. Appropriate completion of homework assignment via the General Grading Rubric.

2.
60 min Preparation: Have available large mural paper divided into 5 parts with Community as the title. The 5 sections should say: Places to Live, Other Buildings, Transportation, Natural Environment, and Community Concerns (such as: pollution, recycling, littering, overdevelopment, water quality and conservation). Have available a piece of paper called the mural planning chart with the same 5 parts as the large mural.
Instruction: Discuss and share homework. Relate this to the large mural. Identify the 5 areas of the Community Mural Collage and discuss. Pass out the small mural planning charts for each child. Watch the video, Planet Neighborhood, and have the children take notes on their mural planning charts. Discuss the video and the notes they took on their charts.
Assessment: Teacher observation of the group discussions and satisfactory completion of the mural planning chart: 1-2 items per area

3.
60 min Preparation: Large Community Collage mural divided into 5 parts, a variety of magazines, scissors, glue plain white construction paper, crayons, the child's mural planning chart from yesterday's lesson, homework assignment from previous lesson, small index card for each child
Instruction: Review the Mural Planning Chart and have them add some of their ideas to the large mural chart. Working in small groups, have the children cut and paste pictures from magazines onto the large mural chart, looking for the 5 components of the community. Paper and crayons should be out to supplement the magazine pictures in case they can't find something they want to add to the chart collage. Discuss the finished collage.
For homework have each student complete an index card with the child's name and complete address.

Assessment: Check to see if appropriate pictures have been placed in the correct areas on the mural. Teacher observation of group discussion and participation.
Tips: Take out any inappropriate pictures from the magazines prior to the lesson. Have a good variety of magazines available.

4.

60 min Preparation: Completed index card (homework assignment) with the child's own name and complete address; a globe; a bulletin board with maps of the world, the United States, your state, and your local community; a photo-copied and laminated local maps with the location of the school starred for each child; one Vis-a-vis pen per pair of children.
Instruction: Briefly, the teacher will discuss where we live on the globe, world map, United States map, and your state's map. In partners, the children will work together to find their school on their own local map. The child will take his/her own index card (homework assignment) and use it as a reference to look for his/her own place of residence on the individual local map. The child will try to trace a path from school to home with a finger first. After he/she has been checked that this is correct, a Vis-a-vis may be used to trace the path. Put the index card on the bulletin board around the local map. Using yarn and push pins, the child can show a line from his/her address card to his/her home on the local, community map. Have a group discussion of the completed bulletin board including these key points: 1. Proximity from home to school 2. Proximity from home to other classmates' homes 3. Proximity from home to other landmarks in the community
Assessment: Correct completion of address card and proper location of address and teacher observation of correct use of maps and identification of landmarks.

5.

120 min Preparation: Divide the class into 5 groups. Have available chart paper and marker for a large chart with 3 categories: Natural Resources, What natural resources do for a community, How natural resources are affected by a community. Find 5 different outside areas to investigate, such as a shaded area, playground, field, front of the school, and blacktop/parking lot. Have a clipboard, paper and pencil for each child to record data from Eco-Probe Measurements. An overhead projector will be needed. Prepare and run off Eco-Probe Measurements recording chart for each child and one for the overhead.
Instruction: Discuss the words "natural resources". Make a list of natural resources at your school, in your community, in your city, and in your state. Prepare to read the story Brother Eagle, Sister Sky by directing them to listen and look for natural resources mentioned throughout the book. Read Brother Eagle, Sister Sky. Chart the Natural Resources section on the chart through reference to the story and class discussion. Have the children name all the natural resources that they know. Next, have the children help you fill in the section on the large chart that says: What natural resources can do for a community. Introduce the Eco-Probe. Discuss how it can measure temperature, light and humidity. Go for a nature walk around the school to look for natural resources. Each child will have their clipboard with the recording chart and a pencil. Each group of children will be responsible for reporting the data from one of the areas around the school on their chart. Each group will report their information to all, and each child will write it on their own chart. As the walk continues, check the temperature, light and humidity in 5 surrounding areas of the school. Pick 5 that may show some differences. (Examples above.) Back in the classroom, compare the results on the children's recording charts. Talk about likenesses and differences and why they think this is happening. Be sure to include in your discussion pollution of the air and water, and

overdevelopment. Have the children discuss the last section on the large chart, How natural resources are affected by a community, and help you fill it in.
Assessment: Completion of Eco-Probe Measurements recording chart, Appropriate use of Probe, Teacher observation of discussion during completion of large chart

6.

90 min Instruction: Discuss with the children the changes that they have seen in their community recently. Discuss what new stores, buildings, houses, etc. and what effect they have on the environment. Introduce the story The Lorax, directing the children to listen and look for changes that take place in the environment in the story. Read The Lorax and discuss. Introduce the terms "earth-friendly" and "sustainability" and what they mean. (Sustainablity, as defined by the President's Council on Sustainable Development is ...to meet the needs of the present without compromising the ability of future generations to meet their own needs.) Relate this to the book The Lorax. Introduce The Graph Club via the large classroom TV monitor in the computer lab. Create a transportation table and bar graph with the children on how they came to school. Relate this graph to the earth-friendly or sustainability concept. Have each child go to their own computer and create a similar table and graph on transportation. They can choose a pictograph, bar graph, line graph, or pie graph as their final project. Print each graph. Back in the classroom, each child will write an analysis of their graph relating to sustainability.
Assessment: Appropriate use of The Graph Club, Analysis of their graph showing an understanding of sustainability
Tips: Seat children in a large group area in front of the large classroom TV monitor. Be sure to preview The Graph Club so you can work with it easily. Enlist the help of extra personnel, such as parents or the technology specialist, to help with the children in the computer lab.

7.

120 min Preparation: Obtain a speaker from a local environmental agency. Choose a program related to Sustainability issues such as: Recycling: Where Does It Go?, or Treasures From the Earth. Kid Pix computer program slide show template, or drawing paper.
Instruction: Review with the children how they could help with the sustainability of their community, in the area of transportation, from the last lesson. Introduce the children to other ways of helping. Discuss the idea of recycling. Who in the class recycles at home? What do they recycle? What do we recycle at school? Read the story Just a Dream, looking for things that could be recycled in the story and the problems that arise when they don't recycle. Discuss appropriate behavior for a speaker. Introduce the speaker. Summarize the speaker's message and relate it to the prior lessons on the community and its relationship to sustainability. After the speaker leaves, have the children each draw a picture pertaining to sustainability in their community either on the Kid Pix template, or drawing paper. Each child will write 2-3 sentences about their picture. Share, discuss pictures and evaluate each other's drawings and their relationship to sustainability.
Assessment: Accurate pictorial representation of sustainability as described by the guest speaker. Appropriate sentences for the picture.
Tips: If time runs out, the picture and text could be done for homework.

8.

90 min Instruction: Review, with the children, what they learned from the speaker, and the

different ways they chose to help their community in their pictures from their last lesson. On the large TV monitor, present Kid Pix Deluxe computer program to the children, if they're not familiar with all the capabilities, and demonstrate the many creative ways of using it and drawing with it. Have each child open Kid Pix on their own computer and open to a blank screen. Looking at their picture from yesterday's lesson, each child will draw a similar picture of their representation of sustainability on Kid Pix. Have each child record their text onto their Kid Pix picture. Each child will save their picture in a designated folder for the teacher. The teacher will assemble all pictures into a Kid Pix slide show at a later time. When completed, present to another class.
Assessment: Completion of slide and voice over for Kid Pix slide show
Tips: Seat children in a large group area in front of the large classroom TV monitor. Teacher should be familiar with the Kid Pix program. Enlist extra personnel, such as parents or the technology specialist, to help with the children in the computer lab.

9.
90 min Instruction: Continue with the discussion of recycling by discussing things that can be recycled, but are not collected at home by sanitation companies. List items that can be taken to recycling centers and how that will help protect the future of our environment. Read Treasure of Trash and have the children listen for ways the children in the book are helping take care of the environment. Discuss with the children how they can make good choices towards making a sustainable community of the future. Urge the children to bring in cans and newspaper for recycling. Explain the program Choices, Choices and how the children can make decisions that will make a real difference in the environment in their community. Play Choices, Choices as a whole class using the large TV monitor. Assessment: Teacher observation of discussion and choices during the whole group lesson.
Tips: Preview Choices, Choices earlier so you're familiar with this program. You might want to put this program in a computer center in the classroom so the children can try out different choices and decisions. Save many of the cans for a possible Math Center (see Center Suggestions) later.

10.
90 min Preparation: Divide the children into 5 cooperative groups, with 4 or 5 in each group, to create an earth-friendly or sustainable community video.
Instruction: Review the previous lesson by talking briefly about how the children in the school in Choices, Choices were able to achieve their goal of winning the soccer game and also clean up their school grounds. Show the video Planet Neighborhood (Home and Car section only) Have the children look for ways people in the video have helped to make their community more earth-friendly or sustainable. Assign individual jobs to each child in their cooperative groups. Possible jobs could be: 1. Group leader-makes sure everyone cooperates and participates 2. Recorder of all brainstorming ideas 3. Recorder of the script of the video earth-friendly advertisement 4. Prop organizer-makes sure that all the needed props are gathered for the video presentation. 5. Video director-makes sure everyone in the group is organized and ready to present their skit for the advertisement. Each group should brainstorm ideas that could be in a TV advertisement showing how responsible citizens can contribute toward a sustainable community. Knowledge from previous lessons should be evident. I'm sure the children can think of many more, but here are some possible ideas: 1. Pack lunches and snacks in reusable containers 2. Carpool 3. Use cloth napkins instead of paper 4. Use reusable bags for shopping 5. Take shorter showers to conserve water 6. Don't

buy products with layers of packaging 7. Don't litter-help pick up the grounds at school and home 8. Walk or ride your bike instead of always riding in the car 9. Plant a tree 10.Don't hold the refrigerator door open 11.Turn off the lights 12.Put a brick in your toilet
After brainstorming, each group will pick 4 or 5 ideas from their list to role play in a video presentation. Each person should have a chance to present one idea in their skit. Each group should begin deciding how they want to present their ideas, and the recorder of the script can begin writing. (If the children are too young to write, they can just practice, or have a parent help.) The prop organizer can begin to make a list of the props that will be needed. Begin practicing the presentation.
Assessment: Ideas should show a relationship to and understanding of sustainability. Teacher observation of group participation and cooperation.
Tips: You may want to make hats or labels for each job in the cooperative groups. You might want parents to come in and help with the practice sessions. Make sure you have close supervision of all groups.

11.
120 min Instruction: Each group should practice their video TV advertisements until ready for the presentation. Hold a dress rehearsal by presenting the entire production for a visiting class or classes. Video tape each group, making sure they're speaking slowly, clearly and loud enough. Watch the video. Repeat taping if necessary. Discuss how this video might be used, and the possible meaning it may have in their community.
Assessment: Teacher observation of accurate information in the video presentation.
Tips: Save this video for possible viewing by the entire school in preparation for school-wide participation in upcoming monthly sustainability activities. This video could be used for a PTA program, or on open house night.

12.
60 min Preparation: Have original KWL Chart from Step 1.
Instruction: Review what each group presented in their TV advertisement. Read The Giving Tree and discuss how it applies to how we can take care of our community. Review the K and W from the KWL Chart in Step 1. Divide the class into 4 cooperative groups. Number each child in the group 1-6. Give the children 10 minutes to discuss what they have learned. Randomly call a child by number to help fill out the What We Have Learned section of the KWL Chart.
Assessment: Teacher observation of the KWL discussion random sampling.
Tip: Have Children seated at 4 tables or grouped desks for cooperative group work.

Worksheets & Handouts
For worksheets and handouts please see this lesson plan's website at:
http://csf.concord.org/esf/Curriculum/Curriculum_DisplayUnit.cfm?ViewID=148

Stewardship of Resources– Comprehensive Program

Created 04/30/00 by: Elaine Davis and Becky James, Russell Elementary, Georgia

Lesson plan also available online at:
http://csf.concord.org/esf/Curriculum/Curriculum_DisplayUnit.cfm?ViewID=147

How does the recycling in our school help our community?
Overview
This unit provides tasks for students in grades K-2 (or 3-5) in all subject areas to focus on "How does the recycling in our school help our community?" as it relates to the Education for a Sustainable Future topic of Stewardship of Resources. The unit is designed to teach students the connections between recycling and the development of a sustainable community. Understanding what "sustainability" means requires thinking about resource use, allocation, and renewal as well as understanding the responsibility society has to make these resources available to future generations. This unit addresses and develops a sense of stewardship through activities, such as literature and experiments and group interaction, that help students learn to rethink and relearn habits needed for a more sustainable future. It is comprised of nine lessons planned for a four to six week period. It is possible to expand the unit into a year long theme if this curriculum strategy matches a teacher's instructional style.

Through activities such as numerous investigations and performance tasks, students will be led to the culminating project: a model of the thoughtful use of resources for sustainable community for the present and for future generations.

Grade Level: K - 2
Curriculum Area: Interdisciplinary
Timeframe: 21 – 25, 1110 minutes Total Estimated Time
Essential Question: How does the recycling in our school help our community?
Subquestions:

- What is recycling?
- What is decomposition?
- What is "now and then" as it relates to sustainability?
- What are recycling opportunities right in your own backyard?
- What happens to items recycled at school?
- What is the difference between natural resources and man made products?
- What are renewable resources?
- What is the purpose and use of landfills?
- What is the importance of sustainable communities?

Results
Students will:
- define "recycle" including the 3 R's (reduce, reuse, recycle)
-define decomposition
-record observations
-recognize growth and change over time

-explain the influence of the past on the present as well as the present on the future as related to the unit topic
-identify and label pictures depicting the past
-observe and chart the areas of recycling opportunities that exist outside the classroom on the school property
-sort and compare the ltter collected into paper, aluminum, glass and metal
-explain what happens to the recycled items that are collected at the school
-create recycling signs using symbols to be used in the classroom, school and home
-design a slide show using Kid Pix Studio which illustrates what happens to the items recycled from the school
-identify natural resources
-create a chart on the computer using Kid Pix Studio illustrating natural resources and man made products
-identify a renewable resource
-explain the purpose and use of a landfill
-create a model of a landfill
-explain the meaning of "sustainable communities"
-build a model of a sustainable community

Preparation

Teacher Preparation:
-locate the local recycling center
-seek knowledgeable people in the recycling business who could be speakers
-determing present recycling efforts by the school
-notify parents about the unit of study

Learner Preparation:
-Students need to understand the concept of rubric assessment
-Students should complete lessons on self, family, community and mapping skills before beginnng the unit.
-Students should experience cooperative group work prior to the unit.

Resources
Unless otherwise noted, all books are available at http://www.amazon.com.

Books:

- The Berenstain Bears Don't Pollute (Anymore), Stan and Jan Berenstain
- Kids For the Earth, Melvin Berger
- Where Does All the Garbage Go?, Melvin Berger
- The Little House, Virginia Lee Burton
- A River Ran Wild, Lynne Cherry
- Yonder, Tony Johnston
- Mousekin's Golden House, Edna Miller
- The Lorax, Dr. Seuss

- If a Tree Could Talk, Rozanne Lanczak Williams
- Reduce, Reuse, Recycle, Rozanne Lanczak Williams

Videos:
- The Lorax, Dr. Seuss
- Magic School Bus Meets the Rot Squad, Based on the book by Joanna Cole
- Recycle Rex. Disney Educational Productions. 1-800-295-5010 (Check with local Keep America Beautiful Affiliate)
- Mister Rogers' Neighborhood: The Environment and Recycling. Stanford: Keep America Beautiful, Inc.

Computer Software :
- Choices, Choices: Kids are the Environment. http://www.tomsnyder.com
- The Graph Club. http://www.tomsnyder.com
- Inspiration. Inspiration Software, Inc.
- Kid Pix Studio Deluxe. Broderbound Software
- Neighborhood Map Machine. http://www.tomsnyder.com
- Sim Town. Maxis,
- Time Line. http://www.tomsnyder.com

Bookmarks:
- Bernie's Recycling Page for Kids - http://www~personal.umich.edu/~bernards/regmain.html
- Cobb's ESF Site- http://www.cobb.k12.ga.us/~Grants
- Keep America Beautiful - http://www.kab.org/
- Keep California Beautiful - www.keepcaliforniabeautiful.com

Teaching Procedures
(See http://csf.concord.org/esf/Curriculum/Curriculum_DisplayUnit.cfm?ViewID=147 for the handouts, worksheets, and other underlined items discussed below.)

1. 60 min

Before beginning unit, see the Recycling Unit Web for an idea of how to lay out this unit.

Hook-Students will complete the first two sections of a KWL chart (see Glossary of Terms) entitled "What is Recycling?" with the teacher. Teacher will read The Lorax by Dr. Seuss. Discuss with the students the following concepts: idea of sustainable community, how the quality of life is affected by the environment and economy as depicted in the story, how we will think about other ways the story could have happened (which will use cause and effect - systems thinking). Students will watch the video, Mister Rogers' Neighborhood: The Environment and Recycling. Students will explain the 3 R's (see Glossary of Terms) (Reduce, Reuse and Recycle) using the Think-Pair-Share strategy (see Glossary of Terms). The teacher will read the book Reduce, Reuse, Recycle by Rozanne Williams and ask students to share examples of each of the 3 R's. Reflect on the 3 R's' and how they contribute to building a

sustainable community.
Assessment: KWL chart, explanation of 3 R's using Think-Pair-Share, Group Reflection Rubric, use of "Kids and the Environment" computer program
Tips: Keep the KWL chart throughout this unit and use as an end of unit assessment. Use the Glossary of Terms for an explanation of the Hook, the KWL chart and the Think-Pair-Share strategy.
The video, Mister Rogers' Neighborhood: The Environment and Recycling, can be obtained from Keep America Beautiful organization.

Add a Performance Task for this Step

2. 120 min

Review the 3 R's as explored in Step 1. Read the book, Mouskin's Golden House, introducing it as nature's way of recycling and reusing. Discuss the changes in Mousekin's pumpkin over time and brainstorm ideas as to the reasons for the changes. Note: We started our unit during the fall so had a pumpkin used for Halloween in our classroom. We used this pumpkin throughout the unit.)
Take the class jack-o-lantern to a selected and protected location on the school's property so that the "pumpkin watch" investigation may begin. Observe changes in the pumpkin at least once a week. Use the digital camera to record the changes and include written notes. Discuss how this contributes to the concept of sustainability through soil renewal. View the video, Magic School Bus Meets the Rot Squad. A discussion of the process of decomposition and its relationship to the environment should follow. Explain how this is an example of the reusing aspect of the recycling process.
Assessment: Observation record of "pumpkin watch" and student created class book using pictures of the pumpkins to explain decomposition will be evaluated using the Performance Task Investigations Rubric.
Tips: The lesson is designed to be used the last week of October or the first week of November.
See Glossary of Terms for an explanation of the brainstorming strategy.

Add a Performance Task for this Step

3. 120 min

Compare and contrast the pumpkin's state from the day it was carved to its present state as an illustration of now and then. Read the book Yonder by Tony Johnston. Create a web depicting the concepts of PAST, PRESENT AND FUTURE based on the story. Teacher will model the effect of the past on the present and the present on the future by describing the history of the television (from radio programs, black and white television, color television, internet on the television to the possibility of wireless television). Students will interview family and friends using the INTERVIEW FORM to trace the development of the telephone as it relates to the past, present and future. Students will share information from their interviews. Read the book The Little House by Virginia Lee Burton. Discuss the past, present and future of the house to help them understand the concept of sustainability.
Assessment: Students will classify items in the web as to past, present, and future. Students will explain the difference between the telephone they use today and the telephone of long ago. Students will predict and design the phone of the future.
Tips: It is helpful for the students to have prior experience with the interview process. The Little House is very appropriate for creating role-playing activities.
This lesson is very appropriate for November seasonal teaching.

Add a Performance Task for this Step

4. 180 min

Review the "K" section of the KWL chart from Step 1 and the story of the Lorax. Introduce the book The Berenstain Bears Don't Pollute by directing the students to find the environmental reasons why the bears were no longer living in a sustainable community. Discuss with the students what type of litter the Bear Family found. Ask the students if they think we will find any litter on the school grounds. Record the comments.

Investigation: After instructing students in the procedures for recording observations, take a walk around the school grounds. The purpose of the walk will be to record the number of paper, cans, glass and metal found on the grounds. Divide the class into four groups and designate one part of the school grounds to each group. Suggestions might be back of the school, playground areas, front of the school, and sides of the school. As the class walks, litter is picked up and placed in the group's bag. The group should tally each piece of litter on the recording sheet as to its type. Use the digital camera to photograph the recycle bins (aluminum cans, newspapers and magazines) located on the school grounds. Upon returning to the classroom, sort the litter from the four bags. Compare the amount of each type of litter with the tallies on the observation sheets. Prepare a graph of the results using "The Graph Club". Display results in the hall. Enlarge the pictures taken with the digital camera of the recycle bins. The students may create posters reminding the student body that the bins exist. A public service announcement could be created to broadcast over the local school announcement system. As a culminating activity, discuss with the students the following question: How does the recycling in our school help our community?

Assessment: Teacher observation, graph made using collected data.

Tips: More information on the importance of recycling can be found with the sites suggested for bookmarking.

An effective class lesson to illustrate the concept of reducing is to have students crush cans collected. Then compare the before and after volume of space used by the cans.

Add a Performance Task for this Step

5. 90 min

Review pictures from the recycle walk in Step 4. Hook – Have students draw a picture illustrating what they think happens to the cans, newspapers or papers that are collected for recycling in their school or communities. Discuss ways in which their parents and grandparents recycled (past). Invite a speaker to discuss what happens to items that are collected for recycling. Students will design recycling signs using the standard recycling symbols for the classroom, school and home. Go on a fieldtrip to the local recycling center. Students will be paired with a partner. They will explain what happens to the items collected at the recycling center using the Think-Pair-Share strategy (see Glossary of Terms). Afterwards the partners will choose one of the items their school recycles and develop a slide show illustrating the recycling process as it relates to sustainability. Students will use Kid Pix Studio to design their slide show.

Assessment: Compare students drawing with the slide show they completed. Evaluate by using anecdotal notes to show growth. Students will write persuasive letter to their family explaining the importance of recycling.

Tips: Use the Glossary of Terms for an explanation of the Think-Pair-Share, recycling symbol, Keep America Beautiful organization.

The student slide shows created in "Kid Pix Studio" can be set to show continuously. This would be a great program for parents to see before a PTA meeting.

The Keep America Beautiful, Inc. organization and its local affiliates are an excellent

resource for information and speakers.
It would be preferable to invite your school PTA's environmental representative as your speaker and to plan the field trip so that students are able to follow the local school pick up for recycling if available.
This would be an excellent opportunity to encourage each classroom and office to set up boxes for discarded paper for recycling. Decorating and labeling the boxes would be a good extension activity for the students.

Add a Performance Task for this Step

6. 120 min

Hook – What do we celebrate on March 2nd with children all over the U.S.? (Dr. Seuss' birthday and Read Across America) Students will name their favorite book. Use Inspiration to create a web with the students illustrating where the paper in their favorite book comes from (book – paper – tree) and introduce the term natural resources. Be sure to provide the opportunity for the children to discover that without the tree there could be no book. Make the connection to the importance of recycling as it affects sustainability. The teacher will read If a Tree Could Talk by Rozanne Williams and discuss with the students. Organize students into cooperative groups (see Glossary of Terms)and give each group a set of cards illustrating natural resources and man made products to sort. Allow each group time to share and discuss. Students create a chart using the stampers and drawing tool in Kid Pix Studio to illustrate natural resources and man made products. Review the natural resource cards and share created chart.
Assessment: In cooperative groups (see Glossary of Terms), students will sort pictorial cards of natural resources and man made products. Students will check sorting activity with an answer key. The chart created by students of natural resources and man made products will also be assessed.
Tips: An easy way to create cards for the sorting activity is to have students draw a picture of what they would buy from their local retail store. Then add pictures of natural resources, which may be easily obtained from computer graphics.
Students could create their charts using Kid Pix Studio during center or independent activity times.
A good follow-up activity would be to have students draw pictures of the natural resources they find in their home and neighborhood.
Use the Glossary of Terms for an explanation of the Hook and cooperative grouping.

Add a Performance Task for this Step

7. 120 min

Hook – Discuss the charts showing natural resources and man made products from Step 6. Refer to the natural resource of water to introduce A River Ran Wild by Lynne Cherry. In cooperative groups (see Glossary of Terms), students will use index cards to sketch and label the life of a river from the Native American time period to present day. Discuss the following question: What did the people learn about keeping the river sustainable for now and the future? Using sequenced index cards, students will create a time line of the river's life on the computer. Allow time for students to share time lines. Discuss the regeneration of the river. Introduce the concept of renewable resources. Students will brainstorm a list of renewable resources associated with the river (examples: water, air, plant life, animal life, etc.)
Assessment: Students will explain the life of the river by using their timeline. They'll also identify a renewable resource.

Tips: Tom Snyder's "Time Line" is an excellent tool for children to use.
Completed time lines could be displayed in the hall.
Time lines could be used in language arts to develop writing skills.

Add a Performance Task for this Step

8. 120 min

Hook – Discuss the way nature recycled the pumpkin through decomposition. Ask students whether nature could use the 3 R's (see Glossary of Terms)to manage all the garbage that people have created. Teacher charts student responses to the question: Where does all the garbage go? Teacher reads the big book,Where Does All the Garbage Go?, and then facilitates a discussion with the students. Invite a representative from your local Keep America Beautiful organization to speak about the purpose and use of landfills.
Investigation: Students build a model of a landfill in cooperative groups of three or four. Complete the activity, "The Layered Look," using the curriculum guide, Waste In Place, published by Keep America Beautiful, Incorporated.
Assessment: Students will record bi-weekly observations of what is happening in their landfill models. These observations may continue for a month or longer. Use the Performance Task Investigations Rubric. Students will compare the results of the decomposition experiment in Step 6 with the results from the model landfill using a Venn Diagram.
Tips: The observations of the landfill may continue as long as needed. It is recommended that they continue for as long as the "pumpkin watch" from Step 2.
A fieldtrip to a local landfill would also be a good extension activity. This could also be included as part of the recycling field trip in Step 5.
Using the Glossary of Terms for an explanation of the Hook and Cooperative groups.

Add a Performance Task for this Step

9. 180 min

Review the K and W sections from the KWL chart (see Glossary of Terms) in Step 1. Have students write about what they learned for five minutes. Record student responses under the last column entitled "L – What did I learn?" Students will watch the video, The Lorax, by Dr. Seuss. Discuss the following questions: In which community would you like to live? Which community do you think was an example of a sustainable community? Teacher will list the reasons the students give for choosing the environmentally friendly community. The teacher will guide the students through the process of making the connections to sustainability by relating to previous steps. Allow students to work with a partner and find pictures from books in the classroom library that might represent a sustainable community. Students should be able to explain why their pictures represent a sustainable community. The teacher may use the following questions: Does your community include recycling? In what ways can your community go on recycling? Why do you think your community is a healthy place to live? Design a rubric for a model of a sustainable community with students. Students working in cooperative groups will complete three-dimensional model of a sustainable community. Students will share and explain their models of sustainable community.
Assessment: Ask students to complete the L section of the KWL chart. Have partners share their pictures of sustainable communities and explain. Have students explain their model of a sustainable community. Use the rubric created with the class to assess (see example of unit project assessment rubric).
Tips: The three dimensional model of a sustainable community is the unit project.

Students may have worked on this throughout the unit.
Students may create a model of their community using the computer program "The Neighborhood Map Machine" and "Sim Town". Relate this activity to the work of an architect.
The big book, Kids For the Earth, could be used as a culminating piece of literature.

Add a Performance Task for this Step

Energy-Related Websites For Kids

Science projects:
Published by the California Energy Commission, this page has links to lots of fun science projects for elementary school kids to do at home.

http://www.energy.ca.gov/education/projects/projects-html/projects.html

Games and puzzles:
Also published by the California Energy Commission, this site has various energy-based games for kids to play at home or in school computer labs.

http://www.energy.ca.gov/education/puzzles/puzzles-html/puzzle.html

Safety With Electricity: Smarty Electric Safety Coloring Book

Join "Smarty" the dog as he learns about electricity safety. This eight-page coloring book can be printed, or you can look at the pictures on the computer. Aimed at younger children. Courtesy of the Sacramento Municipal Utility District.

http://www.energy.ca.gov/education/safety/safety-html/smarty1.html

Saving Energy (Energy Conservation):

Overview of renewable and nonrenewable energy sources in an easy-to-understand format. Tips on how to save energy at home and at school. California Energy Commission.

http://www.energy.ca.gov/education/savingenergy.html

WATTs That?! Junior

An easier version of the original WATTs That?! Game created by the California Energy Commission. Designed for play by 2 students but can be used by just one. Students click on energy-related questions and win a dollar score for each correct response. The game is over when all the questions have been answered and the person with the highest dollar score wins. A fun game to play at home or in school computer labs.

http://www.energy.ca.gov/education/wattsthatjunior/index.html

Alternative Energy Descriptions:
Designed for younger kids, this site contains links to different pages describing the various types of alternative and renewable energies used in California. Good place to find background and supplemental information for homework assignments. Topics include: Biomass Energy, Fossil Fuels, Geothermal Energy, Hydro-electric Energy, Nuclear Energy, Solar Energy, and Wind Energy.

http://www.energy.ca.gov/education/descriptions.html

Additional Online Resources For Educators

The following is a list of websites that provide more information on energy & environmental education for K-12 classrooms.

A Child's Place in the Environment (ACPE) Series

An integrated hands-on environmental education curriculum with children's literature connections for K-6 teachers.

From the website: "*ACPE* is a series of six environmental education curriculum guides for elementary school teachers that integrates science, English-language arts, and selected children's literature, and culminate with student projects which enhance their environment and provide experiences in service learning. All of the lessons in each unit have been correlated to California's content standards in science and English-language arts. Students' pages in Spanish are available."

http://www.acpe.lake.k12.ca.us/

California Integrated Waste Management Board Classroom Curriculum

From the site: "The Board provides curriculum that offers accurate and current waste management information that encourages "reduce, reuse and recycle" in the classroom and home while making it exciting and interesting for both teachers and students."

http://www.ciwmb.ca.gov/Schools/Curriculum/default.htm

Environmental Education (EE) Link

This site is a project of the North American Association for Environmental Education (NAAEE) and contains a directory of information, projects, professional resources and classroom resources from across North America. Intended for educators.

http://www.nceet.snre.umich.edu/classroomresources-directories.html

Energy Education Resources for Parents and Teachers – California Energy Commission

This is the CEC's main site for energy education. Contains many environmental education materials and resources for parents and educators, including the CEC lesson plans, kid's sites, and games listed in this booklet.

http://www.energy.ca.gov/education/resources/index.html

California Department of Education's Environmental Education Website

California's Department of Education site has links to various EE information and resources as well as contact information for state officials dealing with environmental education. Also includes State Department of Education grant opportunities and instructions when available. A great resource with lots of information and links.

http://www.cde.ca.gov/cilbranch/oee/

Education Planet's Environment Page

Vast array of educator-approved resources and services. Extensive search engine allows you to search over 16,000 online lesson plans by keyword and grade.

http://www.educationplanet.com/search/Environment

CREEC.org – California Regional Environmental Education Community

Lists environmental education information, curriculum, and resources for teachers and students. Organized by region to give the most pertinent information for our area. You can also perform a search of the state's environmental education resource directory to find particular items.

http://www.creec.org/

ESF: Education for a Sustainable Future

A vast network of resources for educators interested in teaching about sustainability. Contains curriculum, contacts, news, and a small store. Developed by Cobb County Schools in Marietta, Georgia under funding from the US Department of Education. Contains the two comprehensive lesson guides listed in this booklet as well as several others, all with a focus on sustainability.

From the website: "Sustainable development addresses a group of critical issues that everyone must understand if we are to create the environmental, economic, and social cooperation society needs to move into the 21st century and beyond. Graduates of our schools must be better prepared with the skills and attitudes needed for satisfying and rewarding employment, must have a greater appreciation of the trends and developments that will impact their lives and their progenies', and must be more involved in shaping their communities. Sustainable development issues are urgently needed in the Nation's schools and, because they help students understand their futures, are inherently very interesting and motivating."

http://csf.concord.org/esf/

Glossary of Energy Related Terms

Active solar heating system: special mechanical equipment (such as solar collectors) is used to collect and distribute solar energy for home heating.

Air infiltration: air seepage due to wind; drafts. Air pressure pushes cold air in through tiny openings on the windy side and draws heated air out of the opposite side of the house.

Air lock entry: a porch, vestibule, or entry hall with an inner door and an outer door at the entrance of a house or building. The two doors save energy by cutting down on air exchange when people go in or out.

Barrel: a liquid volume equal to 42 gallons or 159 liters. One barrel of crude oil has about the same heat energy as 448 pounds of bituminous coal, 5,600,000 Btu, or 1,410,579 kilocalories.

Biomass: any organic substance that can be used as an energy source. The most common examples of biomass are wood, crops, seaweed, and animal wastes.

Btu: British thermal unit, a unit for measuring heat energy; Btu is the quantity of heat necessary to raise the temperature of one pound of water one degree Fahrenheit, about one-fourth of a kilocalorie (252 calories).

Calorie: (also: gram calorie) a unit of heat energy; the amount of heat needed to raise the temperature of one gram of water one Celsius degree. It equals 0.00397 Btu.

Caulk: a soft, semi-solid material that can be squeezed into non-movable joints and cracks of a building, thereby reducing the flow of air into and out of the building.

Chemical energy: the energy released when substances combine or break down and form new substances.

Clock thermostat: a thermostat equipped with a timer to change temperature levels automatically at certain times of day.

Combustion: the process of burning a fuel to release heat energy.

Condensation: beads of moisture that form on surfaces as warm, moist air is cooled.

Conduction: passage of heat through a material. Some materials, like glass and metal, conduct heat (and lose it) easily. Insulation helps to block conduction of heat. If ceilings and walls are poorly insulated, they conduct heat from the house to outside.

Convection: transfer of heat by movement of air. As heated air contacts cold surfaces such as windows, it loses heat. The cooled air is denser than warm air, so it tends to settle, pushing warm air toward the ceiling. These temperature changes and air movements form a pattern. Warm, light air from the ceiling area is chilled along the window, becomes heavier and drops to the floor. It moves across the floor, is reheated, moves up the opposite wall, (away from the window), across the ceiling and down past the window again. Each cycle the air loses heat. Heat must be supplied from a sunny window, a furnace, stove, or other heater to maintain a comfortable temperature.

Conversion: the changing of a substance or the energy in it from one form to another.

Conversion efficiency: the percentage of usable energy that is left after an energy conversion. Efficiency = (Energy output / Energy input) x 100

Conversion loss: the amount of energy lost in the changing of one form of energy to another form. Much of this energy loss is in the form of waste heat.

Damper: a trapdoor or other device which controls the passage of air through a duct, chimney, or stovepipe.

Economic efficiency: getting the most benefit from all of our scarce productive resources.

Electrical energy: energy in the form of a flow of electrons that can be produced by chemical activity in a battery, by friction, or by generators. Electrical energy can be transformed to other forms of energy such as light, heat, mechanical, or sound.

Energy: the ability to do work or make things move. Energy exists in a variety of forms (electrical, mechanical, gravitational, light, nuclear, chemical, heat or thermal) and can be converted from one to another. Common units for measuring energy are calories, joules, Btu, and kilowatt-hours.

Energy conservation: actions taken to get the most benefit from our scarce energy resources; promotes energy efficiency.

Energy conversion device: a machine or object that changes one form of energy to another form.

Energy efficiency: the amount of energy it takes to do a certain amount of work. Also, getting the greatest benefit from our energy resources. Efficiency = (Energy output / Energy input) x 100

Ethanol: a liquid, biomass fuel derived from crops, such as corn and wheat; ethyl alcohol.

Flow restrictor: a device attached to a water nozzle or shower head to reduce the flow of water while maintaining the pressure of the spray. This saves energy by cutting down on the amount of hot water being used.

Fossil fuels: coal, oil, and natural gas. This term applies to any fuels formed from the fossil remains of organic materials (plants and animals) that have been buried for millions of years.

Fossil fuel powered electric generating plant: a building in which electricity is produced by burning fossil fuels to make steam which powers the generator. steam which powers the generator.

Fuel: any substance that can be burned to produce heat. (With nuclear energy, a substance that undergoes fission in a chain reaction to produce heat.)

Fuel cell: a device that changes the energy in fossil fuels to electricity.

Gasohol: biomass fuel produced by mixing ethanol and gasoline, typically 10 percent and 90 percent respectively.

Geothermal energy: energy that comes from the heat within the earth. There is more than one kind of geothermal energy, but the only kind that is widely used is hydrothermal energy.

Hydropower: energy that comes from the force of moving water. Hydropower is a renewable energy source but can have negative impacts on the environment.

Hydrothermal energy: most common type of geothermal energy; produced when water

beneath the earth's surface contacts heated rocks and changes into steam. The steam can heat buildings directly or can power turbines to generate electricity.

Insulation: material with high resistance (R-value) to heat flow used to prevent heat loss. The resistance to heat flow is provided by the many small dead air spaces between the fibers or particles. Some commonly used materials for home insulation are fiberglass, cellulose, rock wool, and styrofoam.

Kilocalorie: (kcal) a unit of heat energy equal to 1,000 calories, sometimes called a Calorie or food Calorie.

Kilowatt: a measure of power, usually electrical power or heat flow; equal to 1,000 watts or 3,413 Btu per hour.

Kilowatt-hour: (kWh) the amount of energy equivalent to one kilowatt of power being used for one hour; equal 3,413 Btu, or 860 kcal.

Market Price: price of a good, service, or energy resource, as determined by its price in the marketplace.

Mechanical energy: energy due to the motion of an object. Example: the energy of the moving parts of an automobile engine.

Methane: colorless, odorless gas formed from the decay of organic substances; identical to natural gas.

Methanol: a liquid, alcohol fuel derived from wood, agricultural wastes, coal, and natural gas; methyl alcohol.

Nonrenewable energy sources: finite sources of energy that will eventually run out. Examples are fossil fuels such as coal, petroleum, and natural gas.

Nuclear energy: energy from radioactive decay or from fission or fusion reactions. In a controlled situation it can be used to produce electricity.

Nuclear fuel: material containing atoms whose nuclei split or undergo fission, producing heat energy.

Nuclear powered electric generating plant: a building in which electricity is produced by using the heat given off by nuclear fuel in a controlled chain reaction to make electricity.

Ocean thermal energy conversion (OTEC): a form of hydropower which uses the temperature difference between surface and deep ocean waters to boil and then recondense fluids.

OPEC: stands for Organization of Petroleum Exporting Countries, a cartel that controls a large part of the world's oil reserves.

Opportunity Cost: the value of the next best alternative that is passed up when making a decision; every decision has an opportunity cost.

Passive solar heating system: heating system where a home's design lets in large amounts of sunlight. The heat produced from the light is trapped inside. A passive solar heating system does not rely on special mechanical equipment to produce heat.

Photosynthesis: the process by which green plants use solar energy to convert simple substances into complex ones which contain chemical energy. Carbon dioxide and water are combined, in the presence of sunlight and chlorophyll, into carbohydrates such as sugars, starches, and cellulose.

Primary energy sources: direct sources of energy, including petroleum, coal, natural gas, hydropower, propane, geothermal, wind, solar, and biomass. Primary energy sources are classified as renewable or nonrenewable.

Profit: the amount of sales revenues remaining after subtracting all the costs of production.

Quad: One quadrillion (1,000,000,000,000,000) Btu's.

R&D: stands for research and development.

R-value: the factor which tells how much resistance to heat flow a material has. The higher the R-value, the greater the insulating efficiency of the material. R-values are commonly stated per inch of building material. R-values are additive - thicker material or a combination of materials means increased resistance to heat flow.

R-value standards for an efficient house: Ceiling: R-33; Exterior Wall: R-19; Floor: R-22.

Radiation: passage of energy through open space, like sunlight. During the daytime a building absorbs solar radiation, but after the sun goes down, it starts to reradiate heat to the cold outside air unless something is done to block the radiation.

Renewable energy sources: sources of energy that are considered "unlimited" in supply because they can be replenished quickly or are nondepletable. Examples include solar, hydropower, wind, geothermal, and biomass.

Roof overhang: a solid horizontal or angled projection on the exterior of a building placed (ideally) so that it shades southern windows in summer only, when the sun is high in the sky. This saves on air-conditioning.

Secondary energy source: a source of energy that requires primary sources to produce, for example, electricity. Unlike the primary sources, electricity is not classified as renewable or nonrenewable.

Scarcity: in economics, this situation that exists whenever wants are greater than the resources available to satisfy the wants; scarcity requires people to make choices.

Solar cell: a device that changes sunlight to electricity. Also known as a photovoltaic (PV) cell.

Solar energy: energy in the form of radiation emitted by the sun. The earth receives this energy mostly in the forms of heat and light.

Subsidy: financial assistance given by government to encourage the production of a good, service, or resource; production would be uneconomical without the subsidy.

Solar thermal systems: large collectors concentrate the sunlight onto a receiver to superheat a liquid, which is used to make steam to power electrical generators.

Therm: a unit of measure of the heat energy in 100 cubic feet of natural gas. Equal to 100,000 Btu.

Thermal energy: heat energy; the energy of moving particles within a solid, liquid, or gas.

Vapor barrier: a waterproof liner used to prevent passage of moisture through the building structure. Vapor barriers in walls and ceilings should be located on the heated (indoor) surface of the building. Some insulations come with a vapor barrier attached.

Waste-to-Energy Plant: a plant that burns solid waste to produce usable energy

Watt: a small measure of power, usually electrical power or heat flow; equal to 3.143 Btu per hour. One horsepower =746 watts.

Weather-stripping: material which reduces the rate of air infiltration around doors and windows. It is applied to the frames to form a seal with the moving parts when they are closed.

Wind energy: energy that comes from the movement of air. Using a turbine, energy is produced by converting the wind's kinetic (motion) energy into mechanical energy for grinding grain, pumping water, or producing electricity.

Windbreak: a dense row of trees, or a fence or other barrier that interrupts and changes the local path of the wind. Windbreaks located on the north and west sides of a building can save heat by reducing wind chill and air filtration.

Window treatments: applications to the interior side of windows (blinds, shades, shutters, draperies), used to save energy by keeping heat in or out.