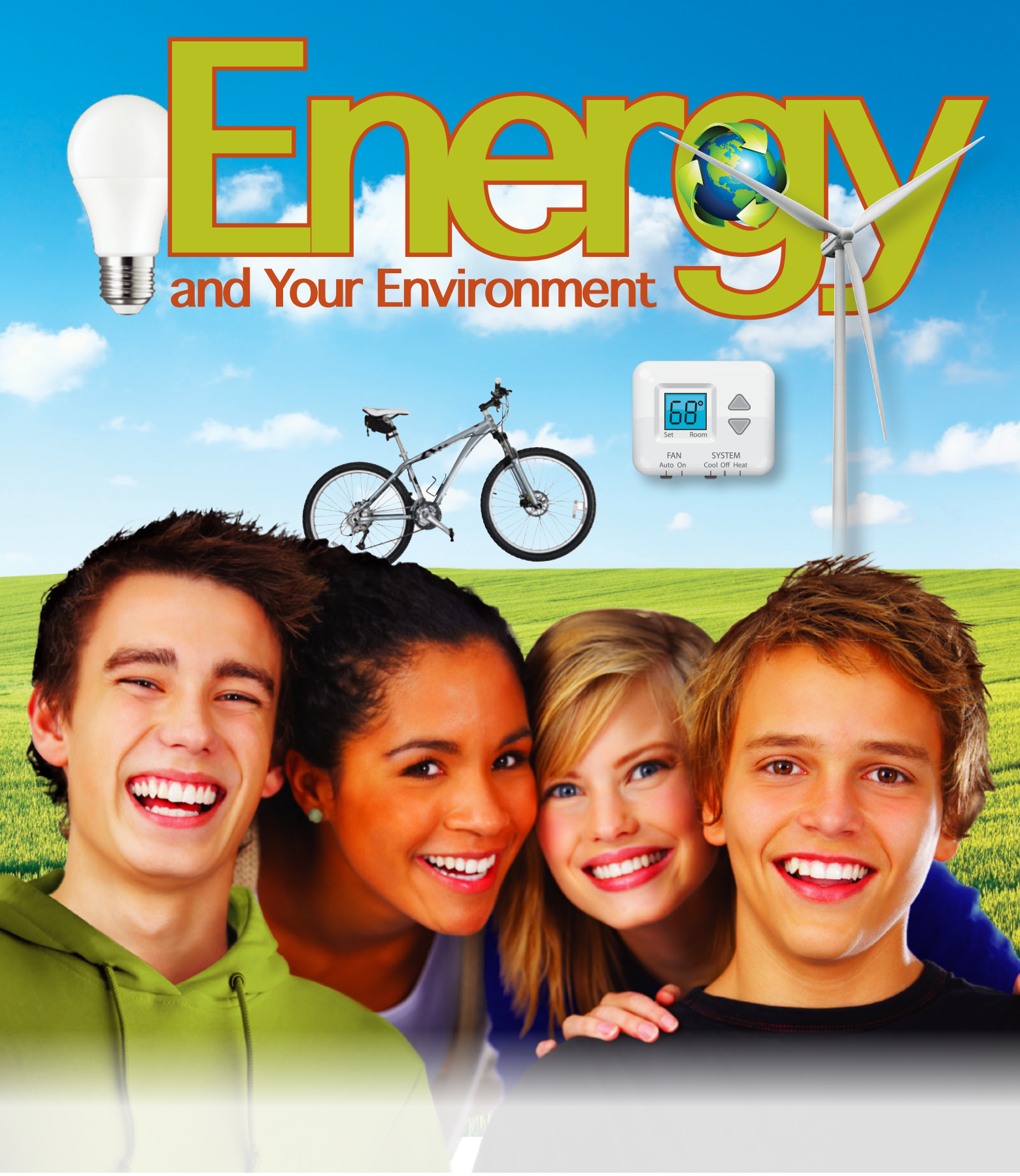
Energy

and Your Environment



santee cooper

Your environment is energetic

Your environment is what surrounds you.

It consists of living and nonliving things, and it is packed with energy. Energy is the ability to do work. Without energy there would be no motion, no light or heat, and life could not exist. The use of energy affects the earth's environment.

KINETIC ENERGY **is moving energy**, like a basketball flying toward the hoop. Heat is actually a form of kinetic energy—the motion and vibrations of atoms in a material.

POTENTIAL ENERGY **is energy that can be converted into kinetic energy**; for example, a sandwich in your lunch bag that will later give you the energy to bike home, or a skateboard at the top of a ramp that releases stored energy when it rolls down the ramp.

Which type of energy (potential or kinetic) does each picture illustrate?

_____ _____ _____ _____

AMAZING FACTS!

Energy cannot be created or destroyed. It can only be converted from one form to another.

WE GET ENERGY FROM THE ENVIRONMENT

When we use energy, we either convert potential energy into kinetic energy, or capture kinetic energy and direct it toward accomplishing a task. We often have a choice of energy sources available to us.

Two Ways to Dry Your Clothes

A. Put clothes in a dryer and wait 30–45 minutes.

An electric dryer runs on electricity that comes over wires from a power generating plant. Electricity can be generated from a variety of energy resources: fossil fuels like coal, oil, and natural gas; falling water, also known as hydropower; nuclear fission; wind; or sunshine, also known as solar power. A gas dryer uses either natural gas or propane.

B. Hang the clothes on the line and wait 2–8 hours.

or

?

What Do You Think?

1. Both drying methods use kinetic energy in some form as the primary source of drying power. What is that kinetic energy?
2. Which method uses nonrenewable resources (i.e., resources that can't be replaced, like fossil fuels)? Can either or both of these methods be considered to use nonrenewable resources?
3. **Challenge:** Where did the energy in fossil fuels come from?

ENERGY USE IN THE ENVIRONMENT HAS changed OVER TIME

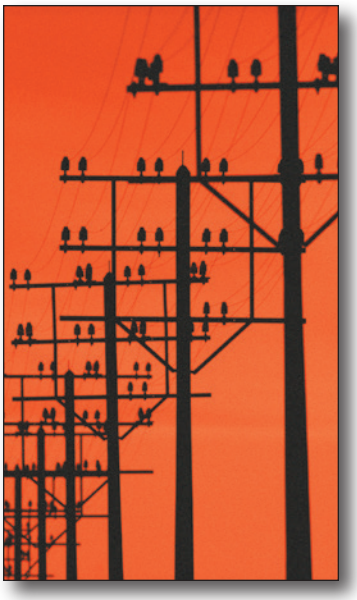
We have always depended on our environment to survive. Early people relied on the **sun's heat energy** for warmth and the growth of living things. Their use of **water**, **wind**, and **wood** had only a slight impact on the environment because the population was so small and the energy resources they used were renewable. Today we rely on other forms of energy and the world's population exceeds seven billion. Our use of electricity, natural gas, coal, oil, and gasoline affects the environment in many ways.

imagine...

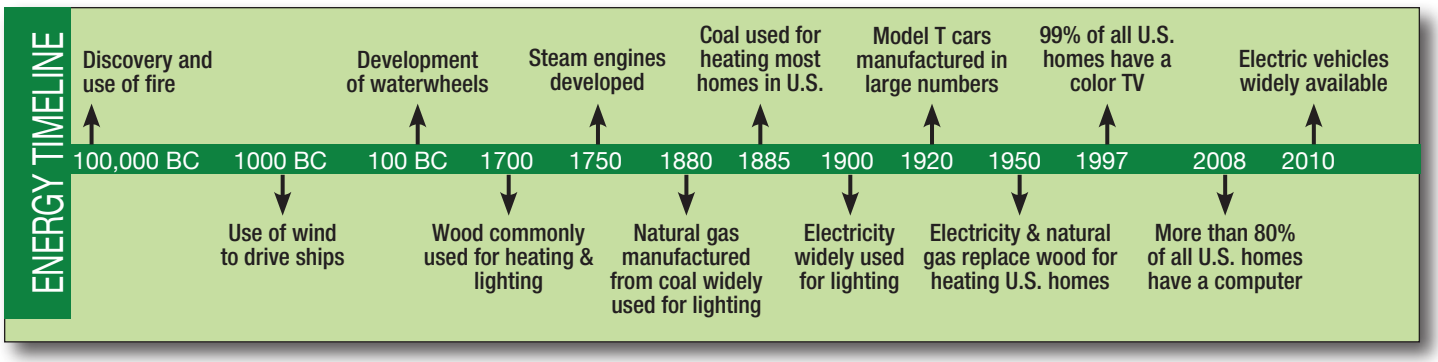
Transport yourself back to the following time periods and describe your environment and how you use energy. Include how you would have cooked your food and kept warm. Explain how you would get the energy to do these things.

PREHISTORIC TIMES

200 YEARS AGO



LAST YEAR



ENERGY PRODUCTION AFFECTS THE ENVIRONMENT IN MANY WAYS

Much of the energy we use has been derived from fossil fuels. When energy is produced in this way, carbon dioxide (CO_2), smoke, soot, and other by-products are released into the environment. There are also environmental effects related to the use of energy from renewable resources like hydropower, wind, and solar power.

COMMUNITY CONNECTION

Which of the environmental effects you identified are felt in your community? Select one and then research what is being done about the issue. Prepare a report based on your research. Discuss what students can do to help, directly or indirectly.

Brainstorm two environmental impacts for each of these energy resources.

ENERGY RESOURCES	ENVIRONMENTAL IMPACTS
Fossil Fuels: • oil • coal • gasoline • natural gas	
Nuclear	
Hydropower	
Wood	
Solar Power	
Wind	

EVERYBODY NEEDS ENERGY

List some of the ways you use energy on a typical school day, from the time you get up in the morning until the time you go to sleep:

morning _____

_____

during school _____

_____

after school _____

_____

evening _____

_____

night _____

_____

If you had to cut your energy use for these activities by half, how would it affect your life? _____

_____

_____

_____

IS IT FAIR?

Some people use a lot more energy than other people. Countries that have a lot of industry use more electrical energy than countries that are not as developed. For example, in the United States the annual electricity use per person is almost twice the annual energy use per person in Japan, about 4.5 times the annual energy use per person in Mexico, and more than 13 times that in Ethiopia.

1. Would it be fair to restrict everyone to the same amount of electricity per year?
2. Work with a group to devise a plan for limiting future energy use to the current global level.
3. Do you think this plan would work? Why or why not?

PAYING THE price FOR OUR ENERGY USE

Each person in the United States pays on average $3,000 per year for energy used for heating, electricity, and transportation.

How many hours do we work for our *Energy Bill?*

How many hours would someone have to work at a job paying $10/hour to pay their $3,000 yearly energy bill? _____

_____

_____

What percentage of an average work year (40 hours/week x 50 workweeks) would it take to pay the bill?_____

_____

_____

Group discussion

What ideas do you have for reducing energy use in homes and for transportation?_____

_____

_____

_____

SPOTLIGHT ON ENERGY EFFICIENCY

The town of Osage, Iowa (pop. 3,800), faced with the high cost of generating more electricity, opted to invest in energy-conserving equipment and programs. The investment paid off.

Town members reduced energy use by 27%, saving $1 million per year in energy costs. That's $250 per person!

LIVING IN A global greenhouse

Many scientists believe that by the time you are your parents' age, the earth's surface will be warmer than it has been at any time in the last 100,000 years. This heating is thought to result from an increase in greenhouse gases in the atmosphere. **Greenhouse gases are transparent (clear) to most incoming light and ultraviolet radiation, but not transparent to outgoing infrared radiation, thus keeping heat within the earth's atmosphere.** Among the greenhouse gases that are increasing due to human activity are **carbon dioxide**, **methane**, and **chlorofluorocarbons**.

Because all of the earth's natural processes are tied to temperature, the warming of the planet is affecting regional climate patterns, snow melt, soil moisture, plant growth, and other functions of living things, along with glacier melt and movement, and ocean currents—all in ways that are difficult to predict.

MAKE A MINI GREENHOUSE

Materials:

- *2 large glass juice bottles of equal size*
- *1 piece of plastic wrap*
- *1 rubber band*
- *4 ice cubes of equal size*
- *2 thermometers (optional, must fit completely inside bottle)*

1. **Place two ice cubes and a thermometer (if used) inside each bottle. Secure plastic wrap over the top of one bottle with a rubber band. Leave the other bottle open.**
2. **Predict:** Which bottle's ice will melt faster?
3. **Place the bottles in a warm, sunlit place. Time how long it takes for the ice to melt in each bottle.**
4. **Observation and Analysis:** Which bottle of ice melted faster?

   _____

   Why? _____

   _____

   _____

   Did the thermometers show different temperatures? _____

   How is what you observed connected to the greenhouse gases in the atmosphere? _____

   _____

Energy Efficiency

REDUCES THE COSTS OF ENERGY USE

It's not energy that people want, it's the services that energy provides, such as the cooking of a delicious dinner and the heating of water for showers. Through new technology, we can get the same services at a fraction of the energy cost.

Automobiles

Today the average midsize car gets about 25 miles per gallon (mpg). The top gasoline-electric hybrid cars get about 45 mpg—almost double. Figuring a yearly mileage of 15,000, how many gallons of gas would these hybrid cars save per year over the average midsize car? How many dollars would that be? (Use the current price of gasoline in your area.)

Refrigerators

A typical refrigerator built in the mid-1980s used 1,400 kilowatt-hours per year (kWh/yr). Newer energy-efficient models use as little as 350 kWh/yr.

How much less energy is used by a newer, energy-efficient refrigerator over a 1980's model? Calculate the answer as the number of kWh saved, and also as a percentage.

ALTERNATIVE FUEL VEHICLES are designed to run on fuels other than gasoline or diesel fuel.

Hybrid electric vehicles use two or more power sources. The most common hybrids on the road today are gasoline-electric hybrids, also called hybrid electric vehicles, or hybrid EVs.

Battery-powered electric vehicles run on electrical energy instead of gasoline or diesel fuel. Instead of a fuel tank, batteries store the electricity that is used to operate an EV. These batteries can be charged by plugging the vehicle into a charging station.

Natural gas vehicles (NGVs) use natural gas that has been compressed into special high-pressure cylinders to get more volume into a smaller amount of space. This is called compressed natural gas, or CNG.

Fuel-cell vehicles (FCVs) are powered by hydrogen fuel cells. Fuel cells produce electricity by combining oxygen with hydrogen. Fuel-cell vehicles operate much like EVs, except they depend on a supply of hydrogen, rather than a battery pack, for power.

Biodiesel vehicles use fuel that can be made from vegetable oils, recycled cooking oils from restaurants, and certain animal fats, such as fish oil or beef tallow. Biodiesel can be used in any diesel engine in place of diesel fuel. No engine modification is necessary.

Conserving Energy at Home

Ask your parents for an estimate of how much your family spent on electricity, natural gas, and gasoline altogether last month. Then show them how they can make monthly savings through some inexpensive energy efficiency measures. As you go through each item, check off the ones you are already doing under "Currently," and those you plan to do under "Goals." Write the date that you meet your goals under "Achieved." Maybe you can talk your parents into passing the savings on to you!

ENERGY USE	CURRENTLY	GOALS	ACHIEVED
TRANSPORTATION			
Make use of bicycles.			
Use buses, trains, and carpools.			
Combine errands to reduce trips.			
LIGHTING & HEATING/AIR CONDITIONING			
Install light-emitting diode (LED) light bulbs.			
Turn off lights when not in use.			
Have your furnace tuned up.			
APPLIANCES			
Use clothesline when possible.			
Set refrigerator on optimum setting.			
Clean coils on refrigerator.			
WATER			
Install a low-flow showerhead.			
Turn down the thermostat on your water heater.			
Take short showers or half-full baths.			

Bonus question: **What type of energy would be conserved by each of these measures?**

ENERGY: HOW MUCH DOES IT TAKE?

DEFINITIONS

Calorie: A measure of the energy value of food. A calorie contains the amount of heat needed to raise the temperature of one liter of water 1° Celsius.

Joule: A standard unit of energy measurement.

BRAIN VS. CAR

Which consumes more energy?

Working it out: We'll figure everything in joules.

1. The average grown person takes in about 2,500 food calories each day. It takes 20% of the body's energy to keep the brain running.
   How many food calories does it take to run a brain for 100 days? _____

   _____

   Convert this amount of energy to joules by multiplying it by 4,184. _____

   _____

2. The average car gets about 25 mpg. It takes about 1.5 gallons of crude oil to make 1 gallon of gasoline. How much crude oil does it take to make a car go 100 miles?

   _____

   Convert this amount of crude oil to joules by multiplying it by 146,000,000. _____

   _____

YOUTH CAN make a difference

People don't realize how much young people can do. There are many places in your community, besides home and school, where you can apply your energy-saving knowledge and your care for the environment.
Here is one example of young people who have made a difference in their community.
What can you do?

Get together with your group or your class and make a big plan, then go out and make it happen!

Spotlight

The students at Santa Cruz High School surveyed their school lighting system, then made calculations showing how much the school would save if they converted to more efficient lights. The school district, after listening to their presentation, contracted with an energy service company to replace the lighting system.

Investigate Your School's Energy Habits

It's a pretty good bet that your school (or school district) could save some money through energy-conservation investments. You don't have to be a supersleuth to figure out how to start saving. One of the best ways to save money is by changing the lights. Just as there have been great advances in household lighting with LEDs, there have also been great advances in lighting technologies for school buildings.

CLASS PROJECT

1. Choose a class representative to ask the head custodian what type of lights are in your fixtures.
2. Contact a lighting store or contractor to find out the most efficient lights that could be used to replace your current lights. Be sure to inquire about LED light fixtures, which are among the most energy-efficient lighting options now available. Find out how much energy (watts) these new lights use, how many hours they last, and their current cost.
3. Estimate how many new lights would be needed to replace all of the existing lights in your school. (If the replacement lights have tubes and ballasts, be sure to estimate for both components.)
4. Estimate how many hours the lights are on over a 12-month period.
5. Multiply hours used per year x number of lights x wattage to get the total watt-hours per year for both the current system and the more efficient system. Then divide by 1,000 to get kilowatt hours (kWh) per year.
6. Multiply kWh per year for both the current and the more efficient system by the school's electricity cost ($/kWh) to get the yearly cost of running the different systems.
7. **Challenge:** If you used money from the yearly energy savings to pay off the cost of the new lights, how long would it take to pay off the new lights?
8. Share your research with the school custodian and principal.
9. Think of other energy uses at your school that you might be able to investigate.

reuse news

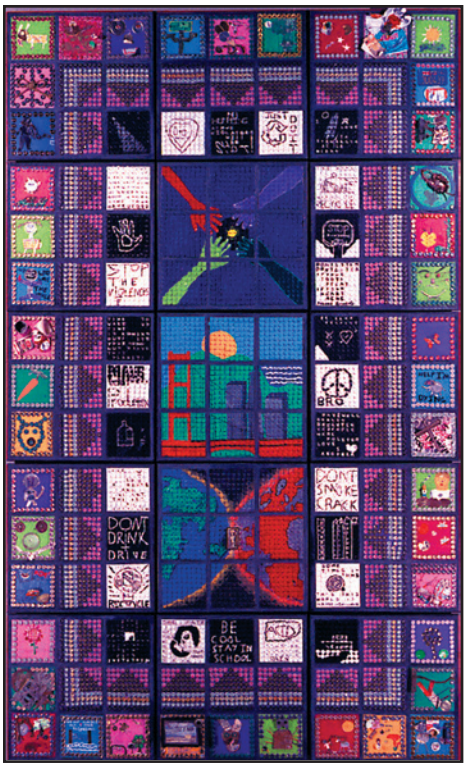
LATE NEWS EDITION

RECYCLING HELPS SAVE ENERGY

A tremendous amount of energy is needed to take raw materials from the ground and turn them into plastic bags, hubcaps, motor oil, cement, aluminum cans, computer chips, and all the many products we use every day. **Recycling eliminates energy use for extraction and drastically reduces energy use for processing.** Reusing a material eliminates all but some energy use for shipping and handling.

EXCLUSIVE

It took artist Remi Rubel and 10 teenagers working full time for five weeks to build this 500-pound mosaic from 8,500 used bottle caps.



COMMUNITY CONNECTION

Find out what recycling programs exist in your community. Are there efforts to support the purchase of recycled products? Choose a class representative to interview the recycling coordinator for your city or county. What goals does he or she have for the future? What could students do to help?

Test Your Energy Savvy

Use the following clues to find the hidden words. Words go forward and backwards, down and up.

N	T	T	A	W	O	L	I	K	F	A	T	S
O	K	O	L	A	N	I	T	O	L	R	E	N
I	A	B	L	P	I	P	E	N	U	O	A	K
T	I	G	E	O	M	E	T	R	O	X	F	I
A	E	I	M	A	U	R	R	O	D	E	R	N
V	L	T	B	Y	O	S	A	G	E	N	I	E
R	C	U	R	U	T	O	C	I	L	A	G	T
E	Y	S	A	P	I	N	L	O	C	U	N	I
S	C	B	I	N	F	R	A	R	E	D	I	C
N	I	D	N	I	R	A	D	A	N	O	S	A
O	B	Y	P	R	O	D	U	C	T	S	U	T
C	O	L	G	E	L	B	A	W	E	N	E	R
Y	T	I	F	U	N	Q	L	B	B	S	R	O

1. A good way to save transportation energy costs is to ride a _____. (p.10)
2. _____ an object saves more energy than recycling it does. (p.14)
3. We pay about $3,000 per _____ for energy each year (not counting food). (p.7)
4. When we dry clothes on a line, we are using _____ energy. (p.3)
5. Greenhouse gases trap _____ radiation. (p.8)
6. This part of your body uses 20% of your body's energy: _____ (p.11)
7. This town's energy efficiency investments save about $250 per person each year in energy costs: _____ (p.7)
8. In converting energy from one form to another, _____ - _____ are given off (hyphenated word). (p.5)
9. This type of light bulb is very energy efficient: _____ (p.10)

CREATING OUR ENERGY FUTURE

If we can change the way we use energy, we can lessen our impact on the environment.

Some solutions are easy, like changing light bulbs. Some are much harder, like redesigning our communities so they aren't so spread out. We already have much knowledge and technology. What we need is commitment and the belief that we have the power to make a difference. One way to start making that commitment is to draw or write your vision.

Join with several classmates to brainstorm how you could make your city, town, or neighborhood more energy efficient. Choose one area, such as transportation, waste disposal, business, agriculture, schools, etc.

Draw or make a collage of how your study area would look with your energy-saving innovations.