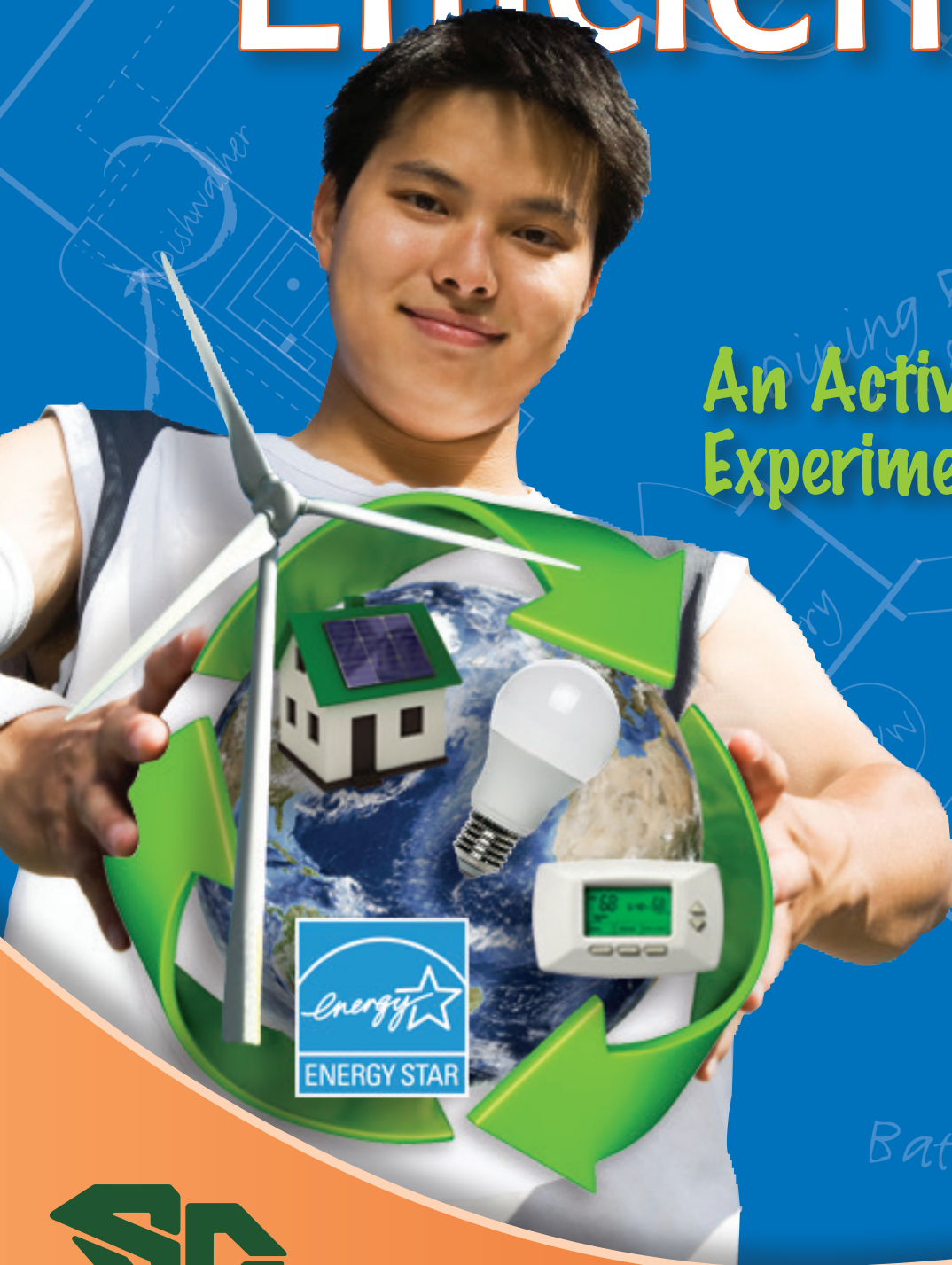


# Hands-On Energy Efficiency

An Activity and  
Experiment Book



santee cooper®

# WHY SAVE ENERGY?

- **Saving energy helps the environment.**

A lot of the energy we use is produced by burning coal, oil, and natural gas. Burning these fuels releases pollutants into the air and adds gases to the atmosphere that contribute to climate change. Saving energy helps reduce air pollution and helps keep the environment healthy.

- **Saving energy saves money.**

Energy costs money. The less energy you use, the more money you can save. Even using a little less energy can save your family a lot of money!



UTILITY CO

WE SUPPLY ENERGY™ ENERGY STATE

## YOUR ENERGY BILL

Account Number	Bill Date	Amount Due	Due Date	Amount Enclosed
123456789	02/21/2016	\$147.45	03/14/2016	

2630.34.799.184972 1 AV 0.293



JANE DOE  
111 MAPLE ST  
ANYTOWN, USA 12345-9999

UTILITY CO.  
123 ELM ST  
ANYTOWN, USA  
12345-9999

203.1043

Please return this portion with your payment. Thank you.

### Telephone Assistance

1-800-123-4567  
Assistance is available by  
telephone 24 hours per day,  
7 days per week.

### Local Office Address

100 OAK ST  
ANYTOWN, USA 12345

### Account Number

123456789

February 2016

### ACCOUNT SUMMARY

Service	Service Dates	Amount
Gas	01/19/2016 To 02/21/2016	\$94.15
Electric	01/19/2016 To 02/21/2016	50.03
		0.10
		3.17
Energy Commission Tax		
Gas PPP Surcharge		
		\$147.45
TOTAL CURRENT CHARGES		154.77
Previous Balance		154.77-
02/16 Payment - Thank You		
<b>TOTAL AMOUNT DUE</b>		<b>\$147.45</b>
<b>DUE DATE - 03/14/2016</b>		



Page 1 OF 4

Form 01-6630 9/98

Each month, your family receives a bill that explains how much energy you used during that month and how much you must pay for it.

Your energy bill shows how many kilowatt-hours (kWh) of electricity you used. What is a kWh? It is 1,000 watts of electricity used for one hour. If you leave twenty 50-watt light bulbs on for an hour, you've used one kWh of electricity.

For natural gas, you pay for the therms or cubic feet. One cubic foot of natural gas is enough to fill 7½ one-gallon jugs.

Find and circle these items on the energy bill shown here:

- **SERVICE DATES** (The period of time the bill covers.)
- **AMOUNT FOR GAS**
- **AMOUNT FOR ELECTRICITY**
- **TOTAL AMOUNT DUE** (The total amount this family must pay for their energy use that month. It includes the cost of delivery services and the cost of the energy.)

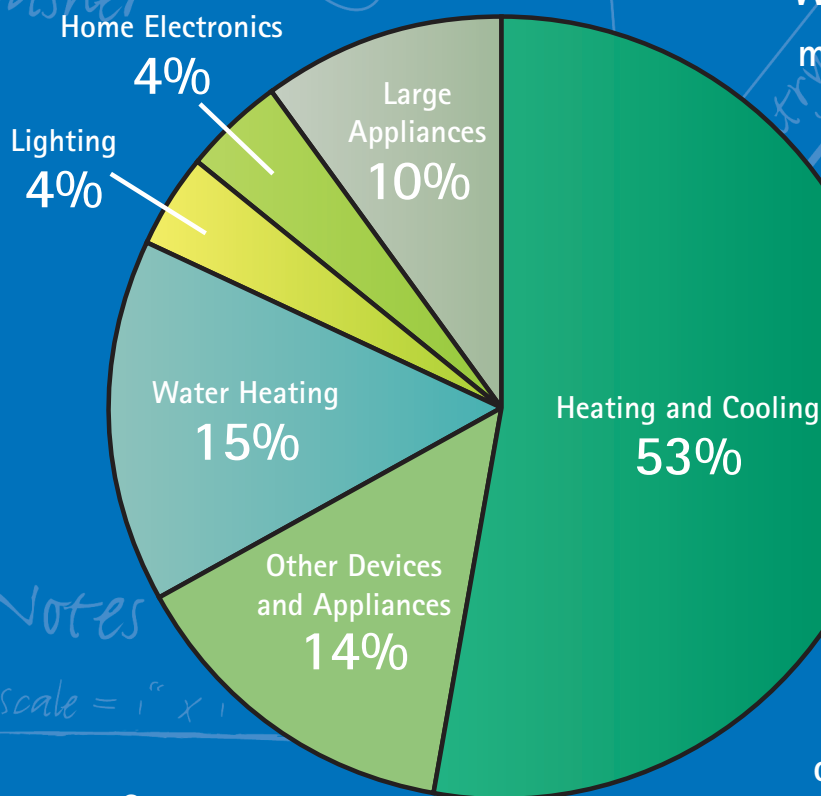
# FIND THE ENERGY USERS

- Look around your home and, on a separate piece of paper, make a list of all the energy-using equipment and appliances you can find.
- Circle any that have earned the ENERGY STAR®. These appliances are designed to protect the environment through superior energy efficiency. You can recognize them by this logo.



## ENERGY EFFICIENCY

An energy-efficient home uses smarter appliances, lighting, and heating equipment to do the same work as standard appliances but with less energy.



Source:  
[www.eia.gov](http://www.eia.gov)

- Which area of this chart requires the most energy? \_\_\_\_\_

Why? \_\_\_\_\_

- What are some items that might belong in the "Large Appliances" and "Other Appliances" sections?  
\_\_\_\_\_  
\_\_\_\_\_

- With a partner, pick one of the areas on the chart and brainstorm a few ways people can use less energy in this area.

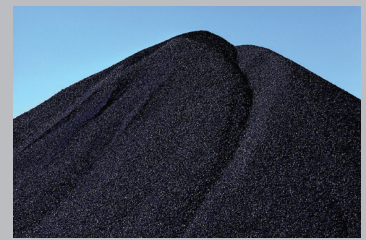


# WHERE DOES ELECTRICITY COME FROM?

A lot of the energy that people use in homes, schools, and offices is in the form of electricity. Various energy resources are used to turn the turbines that generate electricity at power plants. Most electricity is generated by burning fossil fuels, which come from the fossilized remains of creatures that lived long ago.

Fossil fuels, like oil, gas, and coal, have become more expensive, so making electricity from them costs more money than it used to. The more ways we can find to conserve energy, the more money we can save.

Fossil fuels are called **nonrenewable resources** because once we use them up, they can never be replaced. Other energy resources, like sunshine, wind, geothermal, biomass, and hydropower, are called **renewable resources** because they will never run out. When possible, power companies use renewable energy resources, as well as nonrenewable fuels, to produce electricity.



Coal is nonrenewable



Hydropower is renewable

## ENERGY RESOURCES

Here are some energy resources that are used to make electricity.  
See if you can find them in the puzzle.

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

**BIOMASS:** Fuel made from renewable organic materials such as wood, agricultural crops or wastes, and municipal wastes.

**COAL:** A solid fossil fuel found in the earth.

**GEOTHERMAL ENERGY:** Heat and steam from deep inside the earth.

**HYDROPOWER:** Energy from falling water released from streams and dams.

**NATURAL GAS:** A fossil fuel that is primarily made up of methane gas.

**NUCLEAR POWER:** Energy released when uranium atoms are split or combined.

**OIL:** A liquid fossil fuel found deep in the earth.

**SOLAR ENERGY:** Energy from the sun.

**WIND POWER:** The force of the wind.



# HOW MUCH DOES ELECTRICITY COST?

Electrical energy is measured in watts (W). Every device that uses electricity requires a particular number of watts to operate. For example, a light-emitting diode (LED) bulb that is labeled "10W" uses 10 watts.

Since we use so much electricity, it's easier to measure electricity use in kilowatts (kW). A kW is 1,000 watts. A kilowatt hour (kWh) is one kW used for one hour.

## YOU DO THE MATH

The table lists the average number of kWh used each month by typical appliances. Find out how much it costs to run these appliances in your area by filling in the table.

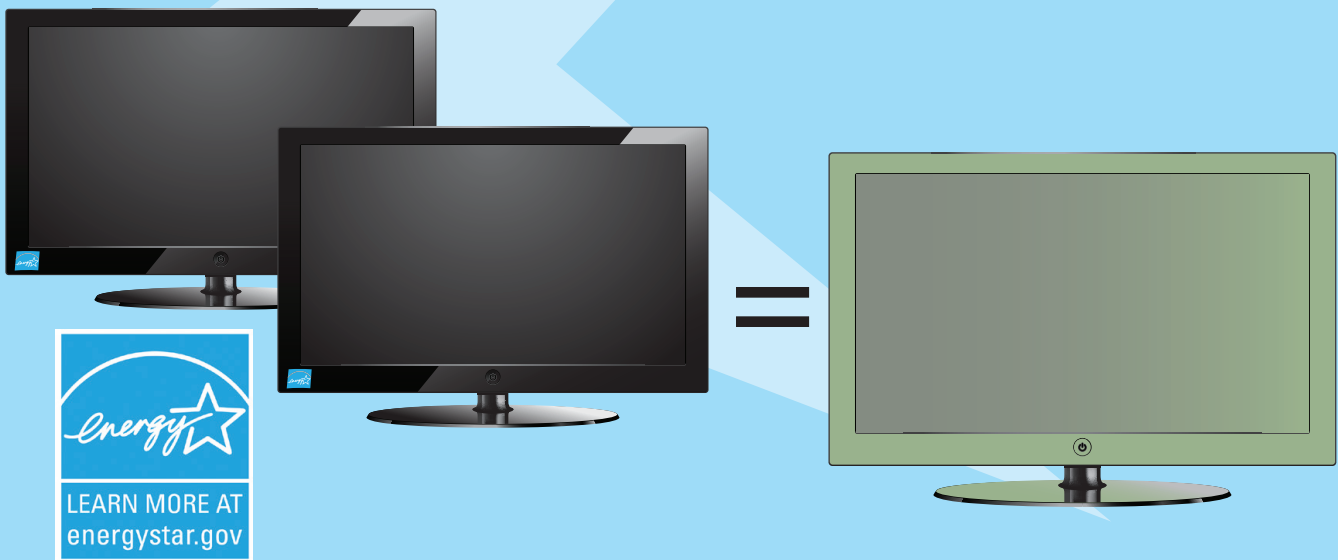
1. Look on a recent electricity bill to find out your cost of electricity per kWh.
2. Multiply the cost by the number of kWh used in a month to find the cost per month for each appliance.



Appliance	kWh used per month	x (multiplied by)	Electricity cost per kWh	= (equals)	Electricity cost per month
Game console	10	x		=	
Clothes dryer	72	x		=	
Electric water heater	400	x		=	
Computer	30	x		=	
DVD player	5	x		=	
Large stovetop	13	x		=	
Oven	120	x		=	
Microwave	36	x		=	
ENERGY STAR refrigerator	50	x		=	
Electric space heater	270	x		=	

# ENERGY STAR® HELPS YOU SAVE

Appliances that have earned the ENERGY STAR are very efficient. They use a fraction of the energy that conventional appliances need to do the same job. For example, new ENERGY STAR certified televisions use, on average, about half the energy used by conventional models. So you could power two new ENERGY STAR certified TVs with the electricity it takes to run one standard TV!



## COMPARE ENERGY COSTS

Use this imaginary example to learn how energy-efficient appliances can save your family money in the long run.



Appliance A is very efficient. It costs \$660 to buy. It uses about \$10 of energy per month.



Appliance B is less efficient. It costs \$600 to buy. It uses about \$20 of energy per month.

- 1 How much more does Appliance A cost to buy than Appliance B? \_\_\_\_\_
- 2 How much less does Appliance A cost in energy per month? \_\_\_\_\_
- 3 Appliance A can make up for its higher purchase price through dollars saved on energy bills. How many months will this take? \_\_\_\_\_
- 4 Why is Appliance A the smarter choice in the long run? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# LET IT SHINE

Compared to traditional incandescent light bulbs, ENERGY STAR certified LEDs use up to 90% less energy to produce the same amount of light. And, they last 10 to 25 times longer. While these bulbs may cost more to buy, they make up for it in reduced energy costs. For example, replacing a 60-watt incandescent with a comparable LED can save your family up to \$80 in electricity costs over the life of the bulb.



Light-emitting diode (LED) light bulb

Incandescent light bulb

## ENERGY EFFICIENCY TIP

If every American home replaced just one light bulb with an ENERGY STAR certified bulb, we would save enough energy to light more than two million homes for a year and prevent greenhouse gases equivalent to the emissions of more than 550,000 cars.

## HEAT...OR LIGHT?

### MATERIALS:

- One 10-watt LED bulb
- One 60-watt incandescent bulb
- One cooking thermometer

An LED bulb requires just 8 to 10 watts of electricity to produce the same amount of light as a 60-watt incandescent bulb. That's in part because the incandescent bulb wastes a large portion of its energy making heat instead of light. Here's how to prove it!

- 1 With the help of an adult, put the LED into a desk lamp and turn it on. Wait 90 seconds, then carefully hold a cooking thermometer 1 inch from the top of the LED. After 90 more seconds, record the temperature. (If the thermometer does not register heat at 1 inch, hold it against the top of the bulb.) \_\_\_\_\_
- 2 Turn off the lamp and then ask an adult to remove the LED and put the incandescent bulb into the lamp. Turn it on. Wait 90 seconds, then carefully hold the thermometer 1 inch from the top of the bulb. After 90 more seconds, record the temperature. \_\_\_\_\_
- 3 Which bulb produces more heat? \_\_\_\_\_
- 4 Lumens measure light, or brightness. Each bulb produces about 800 lumens. About how many lumens per watt does each bulb produce? (Hint: Divide lumens by watts.)  
10-watt LED: \_\_\_\_\_ 60-watt incandescent: \_\_\_\_\_
- 5 Which bulb is more energy efficient? \_\_\_\_\_

*(Safety Tip: Be careful not to touch the incandescent bulb when it is on. And be sure you do NOT use halogen bulbs in this activity. They get very hot!)*

## DO YOU FEEL A DRAFT?

Heaters and air conditioners can do a better job when they don't have to heat or cool the great outdoors. Did you know that tiny air leaks around windows and doors (and especially in attics and basements) can add up to a hole the size of a wide-open window?



## DOES YOUR HOUSE LEAK?



With an adult, check for big gaps or holes. Dangle a tissue or strip of paper where walls and floors meet and around windows, doors, chimneys, pipes, wiring, and wooden molding. Also look for missing insulation in these areas.

If you see the tissue move, feel any drafts, or see any open spaces or gaps, mark these locations with a sticky note or masking tape and ask an adult to fix them. You could visit your local hardware store together to ask about solutions for plugging leaks and replacing old windows and doors with more energy-efficient models.

### ENERGY EFFICIENCY TIP

Adding insulation is another great way to save on heating and cooling costs. Insulation inside walls and attics helps keep heat from escaping during the winter and helps keep heat out during the summer. Insulation is rated by R-value. The higher the R number on the insulation, the better it works to save energy.

The R stands for how well the insulation can *resist* heat flowing through it.



# INSULATION EXPLORATION

Does insulation really make a difference? Do this experiment and find out.

Ask a teacher, parent, or other adult to help you gather and prepare the materials and conduct the experiment.

## MATERIALS:

- Duct tape
- Six 5" by 5" squares of rigid, foil-faced foam insulation (do not use fiberglass insulation)
- Six 5" by 5" squares of cardboard
- Scissors
- Three empty baby food jars with lids
- Hot tap water
- Immersion thermometer
- Marker

## STEPS:

### Prepare the Boxes and Jars

- 1 Using five of the foam-insulated squares, build a box using duct tape to seal the corners and seams. Leave the top of the box open in order to place one of the jars inside.
- 2 Using five of the cardboard squares, build a similar box and also leave the top of the box open.
- 3 Use the marker to label the insulation box "B" and the cardboard box "C." Then label the jars "A," "B," and "C."



### Measure the Starting Temperatures

- 4 Fill jar A with very hot tap water and measure its temperature by placing the thermometer in the water for 30 seconds. Quickly record the water temperature for jar A \_\_\_\_\_, then close the lid. Do the same for jars B and C. Record their temperatures here: B \_\_\_\_\_ C \_\_\_\_\_

### Put the Jars and Boxes Aside

- 5 Place jar B into the insulated box B and place jar C into the cardboard box C. Attach the remaining squares to the top of their boxes using duct tape to seal any cracks. Set aside the two boxes and jar A for 25 minutes undisturbed.

### Measure the Ending Temperatures

- 6 After 25 minutes, open jar A and insert the thermometer for 30 seconds. Record the temperature here: A \_\_\_\_\_ Repeat this process for jars B and C. Record the temperatures here: B \_\_\_\_\_ C \_\_\_\_\_

**DATA ANALYSIS:** Use this table to record all your data.

- Which jar had the greatest change in temperature? \_\_\_\_\_ Why? \_\_\_\_\_

	Starting Temperature	-	Ending Temperature	=	Change in Temperature
Jar A (no box)		-		=	
Jar B (insulated box)		-		=	
Jar C (cardboard box)		-		=	

- Which jar had the least change in temperature? \_\_\_\_\_ Why? \_\_\_\_\_

- Which of your boxes most resembles an insulated house? \_\_\_\_\_

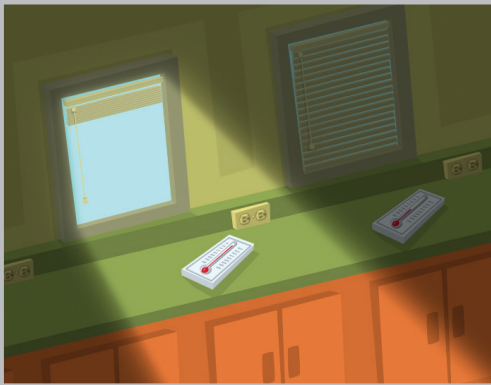
- Which is most like an uninsulated house? \_\_\_\_\_

# SHADE KEEPS IT COOL

- **Ask your family to plant deciduous trees** (trees that lose their leaves in winter) along south- and west-facing walls. In summer, the leafy trees will shade the house. In winter, bare branches will let the warm sun shine through, helping to heat the house.
- **Keep shades and curtains closed on hot days.** Sunlight streaming through a window can rapidly heat indoor air.
- **Ask your family to install awnings above windows** on south- and west-facing walls. An awning shades the window but doesn't block all the light.



## THE WINDOW TEST



On a hot day, find two sunny windows on the same wall of your classroom or another room at your school. Go indoors and close the shades or blinds on one window but leave them open on the other. With your teacher's permission, turn OFF the air conditioning. (If you cannot turn off the air conditioning, you can still do this experiment but the results will be less dramatic.)

- 1 **PLACE** a thermometer in front of each window, about 3 feet away.
- 2 **PREDICT** how the two temperatures will compare after 20 minutes.  
Write your predictions here: \_\_\_\_\_
- 3 **RECORD** the two temperatures after 20 minutes. \_\_\_\_\_
- 4 **COMPARE** your findings with your predictions. Were your predictions correct? \_\_\_\_\_  
Why or why not? \_\_\_\_\_

**Remember to turn the air conditioning back on when you are finished!**

# SAVE ENERGY ON HEATING AND COOLING

- **Shut that door!** How many times have you heard that? Keeping doors and windows shut when heat or air conditioning is on makes good energy sense—and saves energy dollars.
- **Put on a sweater.** In winter, set the heating thermostat to 68°F (20°C) or lower when you're home during the day and even lower at night. Put on a sweater or use extra blankets if you feel cold.
- **Turn it up.** In summer, set the cooling thermostat to 78°F (26°C) or higher. Set it to 85°F (29°C) if you're going to be away for more than four hours.
- **Become a fan of fans.** Use ceiling fans and window fans to cool with less energy. Ceiling fans can also help distribute heat more evenly in winter. Remember to turn fans off when leaving a room. Fans cool people and pets, not rooms.
- **Keep that heater clean.** Make sure your toys and papers (and your family's drapes and furniture) don't block heating vents. Remind adults to have heating systems cleaned annually and to replace furnace filters regularly.



## ENERGY EFFICIENCY TIP

A programmable thermostat can adjust heating and cooling temperatures according to your schedule. For example, you can set it to turn the heat down at bedtime and to turn it back up before you get out of bed in the morning. Ask an adult to consider buying one.

## LIFE WITHOUT AC OR HEAT

Find someone who has lived without air conditioning or central heating. How did they stay cool in the summer? What did they do if it got really cold in the winter? Write up your results, and share them in an oral report to your class.

# Be an ENERGY

## KITCHEN CLUES

- **Do you have X-ray vision?** No? Well, you do have mental powers—when deciding on a snack from the fridge, think first and decide what you want before opening it. Standing in front of an open refrigerator wastes energy!
- **Have you ever looked behind or under your refrigerator?** If you have an older fridge, the coils on the back or underneath are probably full of gunk (gross!). Vacuuming them at least twice a year not only cleans the mess but it helps your refrigerator run more efficiently—saving your family energy and money!
- **Full loads rule.** It takes the same amount of energy to wash a small load of dishes as it does to wash a full load. You might as well wash full loads!
- **If you help cook,** use a microwave oven when you can—it uses less energy than a regular oven.
- **Cookies and cake smell good.** You might be tempted to open the oven to check on them, but this can increase cooking time and waste energy. Keep that oven closed.



## PERFORM YOUR OWN INSPECTION

Observe your family's energy-use habits. List four bad habits in the left-hand column and four ways to improve on the right. Share your suggestions with your family.

### Bad Habits

---

---

---

---

### Ways to Improve

---

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---

---



# Detective

## SECRETS TO SAVING...

### In the bathroom:

- Tell an adult about leaky faucets or other water leaks.
- Take short showers or half-full baths. Showers use less hot water than baths.
- Ask an adult to install low-flow showerheads to reduce hot water use.

Using less hot water is a sure way to save on energy costs!



### In the laundry room:

- Wash clothes in cold water whenever possible.
- Wash only full washer loads.
- Dry clothes on a clothesline or rack.
- When using the dryer, dry loads one after the other to take advantage of heat buildup. If your machine has a moisture sensor, remember to turn it on. This will help avoid over-drying.

## INSPIRE YOUR HOUSEHOLD

How can you help the people in your household improve their energy habits? Make a poster or a set of small signs you can put up around your home to remind everyone about energy-saving actions, like turning off lights, keeping the refrigerator door closed, or washing only full loads of dishes and laundry.



# SAVE ENERGY AT SCHOOL

Like everyone else, schools have to operate on a budget. Most schools spend more money on energy than they do on textbooks and computers combined. Here are some ways you can help your school save money by saving energy.

## Heating and Cooling

- Find the vents in your classroom and make sure they aren't covered by books, furniture, or piles of paper.
- Help keep doors and windows closed when heating or air conditioning is on.



## Water

- Turn off the water in the bathroom when you're not using it.
- If you find a leaky water fountain or faucet or a toilet that is running, report it to your teacher or school custodian.

## Lights and Computers

- Take turns being the energy monitor, and make sure that lights and computers are turned off when not in use.



## ENERGY SAVERS

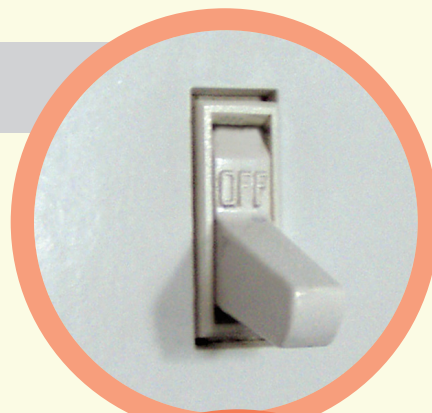
Form an Energy Savers team with a few of your classmates, and go around your school looking for opportunities to save energy. Use the ideas in this booklet as a starting point. Compare your findings with other teams. Make a list of all the ways your school could save on energy costs. Ask your teacher about showing your list to the principal.



# YOU HAVE THE POWER!

Many of the energy-saving changes in this book require the help of an adult, but you have the power to make lots of changes, too. Here are some things you can do on your own every day:

- **Turn off the lights when you leave a room**, even if it's just for a minute. Those minutes add up!
- **Use the "sleep" mode** to power down your computer when it isn't being used for short periods. Turn it off if you won't be using it for an hour or more.
- **Adjust the thermostat** to reduce heating or cooling use.
- **Keep the refrigerator door closed**. Decide what you want to eat before you open the door.
- **Keep doors and windows closed** when heating or air conditioning is on.
- **Turn off or unplug the TV, computer, and related electronic devices** when they aren't being used. Or, use an advanced power strip to automatically turn off power to related devices when you shut off your computer or TV.



Can you think of some other ways you can help your family or classroom save energy? List them below. *(You can look through this booklet to get some ideas.)*

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

## HOW CAN YOU HELP?

Put a check beside the energy-saving activities on this page that you already do. Put a star next to those you would like to start doing.

# SAVE ENERGY & SAVE MONEY



Bath tub

Saving money on your energy bills means following energy-saving practices around your home. Try the following tips, and see how much energy and MONEY you can save!

Tip	Money saved per year
1 Replace five frequently used light bulbs with models that have earned the ENERGY STAR.	\$80
2 Lower your thermostat on winter days, and raise it on summer days by 7°F (about -14°C).	\$93
3 Unplug electronics you are not using, or use an advanced power strip to automatically turn everything off at once.	\$50
4 Install energy-saving showerheads and faucets.	\$37
5 Lower your water heater setting to 120°F (49°C).	\$95
6 Use only cold water to wash clothes.	\$67
7 Line dry your clothes.	\$119

*Savings figures are based on national average energy costs and usage. Actual savings will vary significantly from home to home.*



scale = 1" x 1"