

Building Buddies

Student Guide

2015-2016





Energy at Home and School

History of Energy

A long time ago, Native Americans used **biomass** for energy. Biomass is anything that was alive a short time ago—like plants and animals. They burned wood to cook food and warm their homes. Sometimes, they burned dried animal dung.

The sun gave them light in the day. Their fires and the moon and stars were their only lights at night.

Some early Americans lived in tents made of animal skins called teepees. Others lived in mud and rock homes or in caves. Some of the caves were deep in the Earth. The caves were warm in the winter. Heat from inside the Earth—**geothermal** energy—kept them warm.

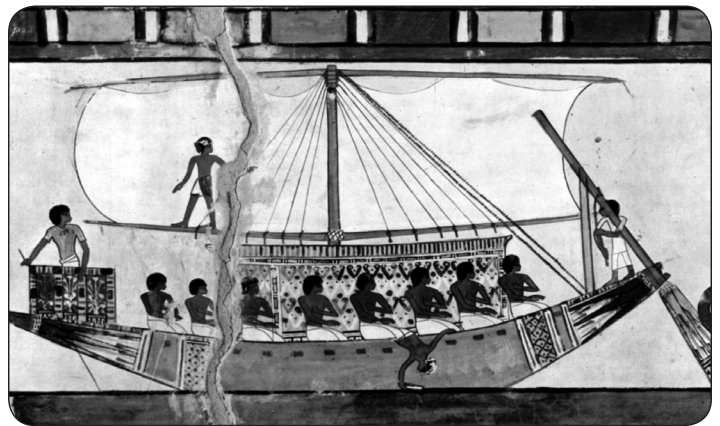
The early settlers arrived on boats with sails. They used the energy in the **wind** to travel to the New World.

They built houses out of wood. They burned wood to keep warm and cook their food. They had no fans or air conditioners to keep them cool in hot weather.

They made candles from animal fat so they could see at night. Many settlers rose at dawn and went to bed when the sun went down.



Biomass is a good source of energy.



Egyptians were some of the first people to use sails to capture the wind's energy. This painting depicts a riverboat that was used over 3,000 years ago.

The settlers used water wheels to grind grain and run sawmills. They made the energy in moving water—**hydropower**—work for them.

As the years passed, people discovered **coal**, oil (**petroleum**), and **natural gas** under the ground. They learned they could burn them to make heat.

They learned how to make **electricity**. They learned that electricity is a good way to move energy from many sources to the people who need it.



Water was used to turn a large wheel, which helped settlers grind grain.

What Is Energy?

Energy is a part of everything that happens in the world, everything we do. Energy is heat, light, sound, and motion. Energy is electricity.

Energy is the ability to make a change or to do work.

We get our energy from many different sources. Some **energy sources**, such as the sun and the wind, are **renewable**. They can be made quickly or renewed over and over again. We will not run out of renewable energy sources.






Some energy sources, such as oil and coal, are **nonrenewable**. They can take hundreds of millions of years to form. We cannot make more quickly. Once we use them, they are gone forever. We could run out of nonrenewable sources.

We use many energy sources, both renewable and nonrenewable, to make electricity. Electricity makes it easy to do many jobs.






Most of the energy we use today comes from nonrenewable energy sources. We need to save energy whenever we can.

U.S. Energy Consumption by Source, 2013

NONRENEWABLE

	PETROLEUM 35%
	<i>Uses: transportation, manufacturing</i>
	NATURAL GAS 27%
	<i>Uses: heating, manufacturing, electricity</i>
	COAL 19%
	<i>Uses: electricity, manufacturing</i>
	URANIUM 8%
	<i>Uses: electricity</i>
	PROPANE 2%
	<i>Uses: heating, manufacturing</i>

RENEWABLE

	BIOMASS 5%
	<i>Uses: heating, electricity, transportation</i>
	HYDROPOWER 3%
	<i>Uses: electricity</i>
	WIND 2%
	<i>Uses: electricity</i>
	SOLAR < 1%
	<i>Uses: heating, electricity</i>
	GEOTHERMAL < 1%
	<i>Uses: heating, electricity</i>

*Total does not add up to 100% due to independent rounding.
Data: Energy Information Administration

Heating and Cooling

Homes and schools use energy for heat. We use many energy sources to heat buildings. Most homes and schools use natural gas for heating. Some use electricity. Some use solar energy, biomass, oil, or propane for heating.

Homes and schools use energy to cool their buildings, too. We use electricity to cool most buildings.

To save energy when heating and cooling buildings:

1. Keep windows and doors closed when heating or cooling.
2. Open blinds on cold, sunny days to let in the sun's energy and close them on cold nights so heat does not escape.
3. Close blinds on hot, sunny days to keep out the sun's energy.
4. Dress warmly in cold weather so that you don't need to use so much heat.
5. Dress in light clothes in hot weather to stay cooler.
6. Use warm blankets on cold nights and turn down the heat.
7. In warm weather, open windows and use fans instead of air conditioning.



Open blinds on cold, sunny days and close them at night.

Lighting

Homes and schools use energy for lighting. We use electricity to light most buildings.

To save energy for lighting:

1. Turn off lights when you leave a room.
2. Use the sun's light whenever you can.
3. Use outdoor lights only when needed.
4. Use only the light you need for a task. To read, for example, use a reading lamp, not an overhead light.
5. Use energy-saving fluorescent lights in schools.
6. At home, use energy-saving **compact fluorescent light bulbs** (CFLs) or **light emitting diodes** (LEDs) instead of **incandescent light bulbs**. They save energy and money.



Use energy-saving light bulbs like LEDs and CFLs.

Energy at Home

Maria lives in Florida. It doesn't get too cold there, but it gets very hot. Keeping cool on hot days is important. Air conditioning uses a lot of energy.

Maria's family saves energy and stays cool. They have ceiling fans in almost every room. They have trees around their house for shade. They close the blinds on sunny days.

Jack lives by himself in a cabin in Alaska. He never worries about staying cool. He does think about staying warm during the long winters. He also needs to make light during the winter because it can be very dark.

Jack's cabin doesn't have electricity. Jack burns wood in a big stove for heat. He cooks on the stove, too. He heats water on the stove for his bath. He burns kerosene in a lantern when it gets dark.

Jack's cabin has small windows. Each window has two pieces of thick glass to keep in the heat. He has heavy blinds on the windows, too. He opens the blinds when it's sunny, and closes them at night.

Angel lives in Colorado. It gets hot in the summer. It gets cold in the winter.

Angel lives in an underground house. It is built into a hill with grass growing on top. Only one side is not underground. This side faces south and is made of windows. On top of the hill is a windmill.

Heat from inside the Earth and light from the sun keep Angel's house warm in the winter. The temperature of the Earth underground keeps her house cool in the summer. The sun lights the house during the day. At night, Angel uses electricity made by the windmill and stored in a battery.



Maria's house in Florida.



Jack's cabin in Alaska.



Angel's house in Colorado.

Heating Water

Homes and schools use energy to heat water. We use several energy sources to heat water—usually natural gas or electricity.

To save energy when using hot water:

1. Take short showers instead of baths.
2. Wash your hands and brush your teeth with cold water.
3. Do not leave warm or hot water running.
4. Do not wash dishes under running water. Fill the sink with warm water to wash dishes and cool water to rinse.
5. Rinse the dishes in a sink of cool water before putting them in the dishwasher; then run the dishwasher on the shortest cycle.
6. Wash clothes in warm or cold water and always rinse in cold water.
7. Ask an adult to wrap the water heater in an insulating blanket.
8. Ask your parents to set the water heater at the lowest temperature needed.



Water Heater

Machines and Appliances

Homes and schools use energy to run machines and appliances. Most machines and appliances use electricity for energy.

To save energy when using machines and appliances:

1. Turn off machines and appliances when you are not using them.
2. Refrigerators and freezers use a lot of energy to keep food cold. Decide what you want before you open the refrigerator door. Do not leave the door open for a long time.
3. Run the dishwasher only when it is full; use the energy-saver mode and allow the dishes to air dry.



Refrigerator

Cooking

Homes and schools use energy to cook food. We use several energy sources to cook food—natural gas, electricity, and propane.

To save energy when you are cooking:

1. Use a toaster oven or microwave instead of the oven whenever you can. These smaller appliances use less energy.
2. Preheat the oven for only five minutes.
3. Leave the oven door closed so hot air doesn't escape. Use a timer or look through the oven window to check on cooking food.



Stove

Products and Trash

It takes energy to make the products we use every day. It takes energy to dispose of the trash we throw away every day. We throw away a lot of trash. We waste energy when we do that.

You can save energy by:

1. Reducing the amount of trash you throw away. Buy a small can of concentrated juice instead of a large container.
2. Reusing things instead of throwing them away. Use the Sunday comics for wrapping presents. Use refillable water bottles.
3. Repairing broken objects instead of throwing them away and buying new ones. Fixing a broken TV can save money, too.
4. **Recycling** things instead of throwing them away. Recycling almost always saves energy and resources.
5. **Composting** food and yard waste instead of throwing it away. Compost makes good fertilizer for your garden.



Reduce



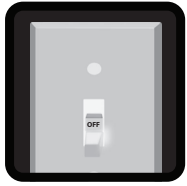
Reuse

Saving Energy

There are many ways you can save energy at home and at school. When you save energy, you save money. When you save energy, you save our natural resources. When you save energy, you protect Earth's environment.



Recycle



Energy at School

The early settlers wanted their children to know how to read and write. They wanted them to understand math. At first, the children were taught at home by their parents. Many times, there were only a few books in the house. The children learned to read using their parents' books.

Some people hired tutors to live in their homes. The tutor taught all the children in the house. Sometimes, cousins would travel a long way to study with the tutor. They would stay at the house for months at a time to learn.

As more settlers arrived, towns were built. The people built schoolhouses and hired teachers so that their children could go to school. Usually, the schools were just one room. One teacher taught all the students from first grade through high school. Students shared desks as well as books. There was no paper to write on; the students wrote on pieces of slate.

In cold weather, a stove in the middle of the room provided the only heat. The best seats were near the stove. The biggest boys carried in wood to keep the fire going. Snow would blow in through the windows and cracks in the walls. Even with the stove going, sometimes the children had to keep their coats and mittens on all day.



A one room school house.



Early settlers used wood stoves like this to stay warm and cook their food.



Today's schools have many machines and appliances that use electricity. These students are reading information that explains how much energy the television uses.

There was no kitchen or indoor sink. The only light came in through the windows. The bathroom was an outhouse behind the school building. There was no kitchen. Students brought their lunches from home.

There were no school buses, of course. Students walked or rode horses to school. Sometimes, they lived several miles from the school.

Today, schools are very different. They have many rooms and many teachers. They have heat to keep students warm in winter. Many have air conditioning to keep students cool in warm weather. They have lights and bathrooms and kitchens. They have running water for washing hands, drinking, flushing toilets, and washing dishes.

Today's schools have computers, projectors, copiers, televisions, clocks, intercoms, VCRs/DVD players, CD players, and many other machines. They help students learn. Schools today use a lot of energy to provide a good place for students to learn. This energy costs a lot of money. You can save energy at school like you do at home.



Energy at School 2



Ms. Murphy drove into the parking lot in her new car. She turned off the engine, got out of the car, and locked the doors. She walked through the snow and into the school office to check her mail box.

"Hi, Ms. Murphy," said the secretary. "Robert's mom left a message saying he won't be in school today. He's sick."

"Thank you, Ms. Gonzales. Is this a good time for me to use the copy machine?"

"Yes, it is," answered Ms. Gonzales, glancing at the clock on the wall. "Mr. Katz won't be in for fifteen minutes."

Ms. Murphy made copies of the worksheets she needed and walked to her classroom. She turned on the lights and looked around the room. It looked very clean. The new janitor, Mr. Barker, had vacuumed the carpet and emptied the trash.

She hung her coat and scarf in the cloak room. Her classroom was warm. Mr. Barker had come in early to make sure the furnace was working on this first day of winter weather.

Ms. Murphy walked down the hall to the teacher's lounge. She put her lunch in the refrigerator and drank a cup of hot coffee. Soon the children would be arriving. She hurried back to her classroom.



The bell rang. Children with snow-covered hats and jackets bustled into the classroom. Ms. Gonzales announced over the intercom that Bus 56 would be late today.

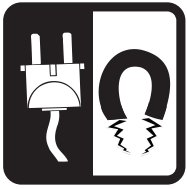
After taking attendance, Ms. Murphy turned on the television. The children watched the school news team reporting on yesterday's spelling bee. Morgan Brown from their class was the winner. Everyone cheered for Morgan.

In the morning, the A Team used the class computers to write stories about the early settlers. The B Team practiced using their new solar calculators for math. Then, the teams switched places.

At 12:00 p.m., the students washed their hands and headed for the cafeteria. It was Friday, their favorite day. Pizza was always on the lunch menu on Friday. The students took cold drinks from the cooler and plates of hot pizza from the lunch line.

After lunch, the students headed to the gym. They were learning to square dance. Ms. Gray turned on the CD player and showed them a dance from pioneer days.

Back in class, everyone watched a video about the sun. The students made a list of the ways they use solar energy every day. Then the bell rang. It was 3:00 p.m. Time to go home.



How Electricity Has Impacted Our Lives

BOX ONE

BOX TWO

1. Draw one more picture on each side.
2. What picture did you add to Box One?

3. What picture did you add to Box Two?

4. What do you notice all the things in Box One have in common?

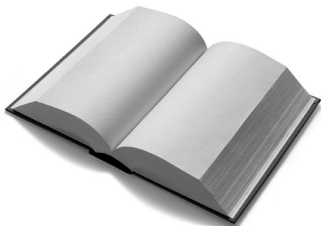
5. What do you notice all of the items in Box Two have in common?

6. Add a label to the top of each box.
7. Your Grandpa said that, "Kids these days have it easy." Do you think he is right? Why or why not?



How Electricity Has Impacted Our Lives

Cut out each picture. Sort them into two groups. Each group will have seven items in it. Glue them down on the previous page in the correct boxes. When they are glued down, leave blank space on each side for you to add drawings. Answer the questions about the pictures.



B L A N K P A G E



Energy Source Matching

Write the number of the energy source on the line next to its definition.

- | | | |
|---------------------------|-------|--|
| 1. Petroleum (oil) | _____ | Black rock burned to make electricity. |
| 2. Wind | _____ | Energy from heat inside the Earth. |
| 3. Biomass | _____ | Energy from flowing water. |
| 4. Uranium | _____ | Energy from wood, waste, and garbage. |
| 5. Propane | _____ | Energy from moving air. |
| 6. Solar | _____ | Energy from splitting atoms. |
| 7. Geothermal | _____ | Portable fossil fuel gas often used in grills. |
| 8. Hydropower | _____ | Fossil fuel for cars, trucks, and jets. |
| 9. Coal | _____ | Fossil fuel gas moved by pipeline. |
| 10. Natural Gas | _____ | Energy in rays or waves from the sun. |



Energy We Use at Home and School



We can HEAT with

- natural gas
- electricity
- coal
- biomass
- propane
- geothermal
- petroleum
- solar



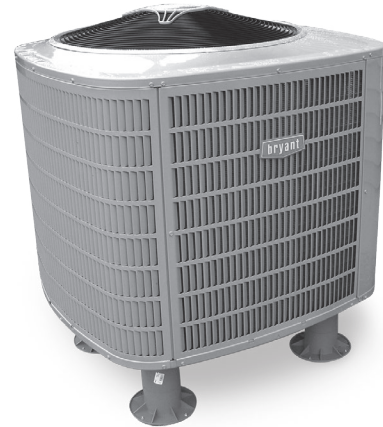
We can HEAT WATER with

- natural gas
- electricity
- propane
- solar



We can LIGHT with

- electricity
- solar



We can COOL with

- electricity



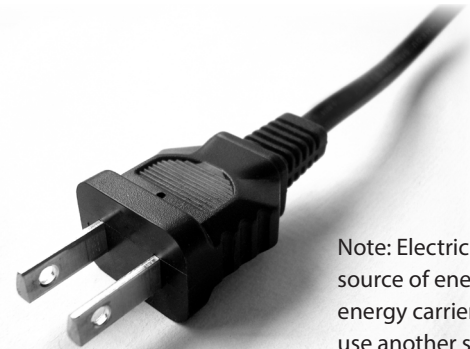
We can run APPLIANCES with

- electricity



We can COOK with

- natural gas
- electricity
- propane
- biomass
- solar



Note: Electricity is not a source of energy, but an energy carrier - we must use another source to get it.

We can make ELECTRICITY with

- coal
- hydropower
- petroleum
- solar
- uranium
- natural gas
- biomass
- wind
- geothermal

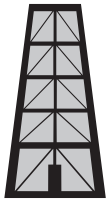


Renewable or Nonrenewable

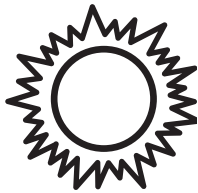
Cut out the symbols for the energy sources and glue them in the correct box.

RENEWABLE

NONRENEWABLE



Petroleum



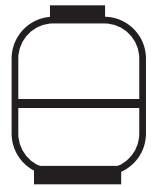
Solar



Wind



Coal



Propane



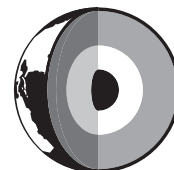
Biomass



Hydropower



Natural Gas

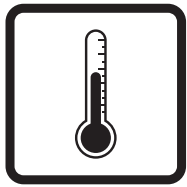


Geothermal



Uranium

B L A N K P A G E



Exploring Temperature

Most of a school's energy is used to control the temperature of the air in the buildings. Students and teachers work better when they are comfortable—not too hot or too cold.

What is a comfortable temperature? It depends on what you're doing. You can be comfortable in very cool weather with just a shirt and shorts if you're playing soccer. The people sitting in the stands might need a jacket. It depends on the season, too. A day that feels cool in the summer might feel very warm in the middle of winter.

1. Heat flows from hotter objects to cooler objects. Heat flows until everything is in balance. That means the objects in your classroom are at the same temperature. Touch objects made of the materials listed below and circle how they feel. Do they feel hotter than the air, colder than the air, or the same?

Metal	hotter	colder	the same
Glass	hotter	colder	the same
Plastic	hotter	colder	the same
Wood	hotter	colder	the same
Fabric	hotter	colder	the same

2. Using a thermometer, record the temperature of the things listed in Fahrenheit (F) and Celsius (C) scales.

Human Body	98.6 °F	37 °C
Classroom Air	_____ °F	_____ °C
Outside Air	_____ °F	_____ °C
Ice Water	_____ °F	_____ °C
Warm Water	_____ °F	_____ °C

3. Fill a container with water the same temperature as the air in the classroom. Use the thermometer to find the temperature. How does it feel compared to the air?

Air	_____ °F	_____ °C	too warm	too cool	just right
Water	_____ °F	_____ °C	too warm	too cool	just right

4. Do you usually like the air to be hotter or colder than your body? Why?
5. When might you want water to be colder than your body?
6. When might you want the water to be the same temperature or warmer than your body?



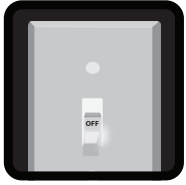
Energy at School 1

Find out what energy sources your school uses. Take a tour of your school with a school employee—look at the furnace, the electric meter, the gas meter, the air conditioning system, and the hot water heater. Look in the kitchen to see the energy sources used there.

Answer the questions below after you take a tour of your school.

1. What kind of energy is used to heat the school?
2. What kind of energy is used to cool the school?
3. What kind of energy is used to cook the food?
4. What kind of energy is used to heat the water?
5. What kind of energy is used to run the lights and machines?

Other things you learned from your tour of the school building:



Energy at School 2

Draw a picture of your classroom in the box below. Use the symbols to show the appliances, lights, electrical outlets, heating and cooling devices, vents, ceiling fans, windows, and doors.



Door



Window



Appliance
or
Machine



Ceiling
Fan



Heating/Cooling
Vent or Device



Light



Electrical
Outlet



Water
Heater



Sink or
Fountain



Computer or
Printer

My Classroom



Be a Building Buddy

There are lots of ways to save energy at school. Here are some things that kids can do to be Building Buddies and save energy at school.

Heating and Cooling

- 1.
- 2.
- 3.
- 4.
- 5.



Water

- 1.
- 2.
- 3.



Lights and Machines

- 1.
- 2.
- 3.
- 4.
- 5.



Building Buddies

Saving energy is not hard—you just need to make it a habit. Be a Building Buddy—give people and classrooms smiling apple stickers when you catch them saving energy.





Home Energy Survey

Find out what energy sources your home uses. Take a tour of your home with an adult. Look at the heating system, the air conditioning system, the stove and oven, the electric meter, and the hot water heater.

Answer the questions below with your family's help.

1. What kind of energy do we use to heat our home?
2. What kind of energy do we use to cool our home?
3. What kind of energy do we use to cook our food?
4. What kind of energy do we use to heat our water?
5. What kind of energy do we use to run our machines and appliances?

With your family, make a list of five things you can do to save energy at home.

- 1.
- 2.
- 3.
- 4.
- 5.

R - Refrigerator

S - Stove/Oven

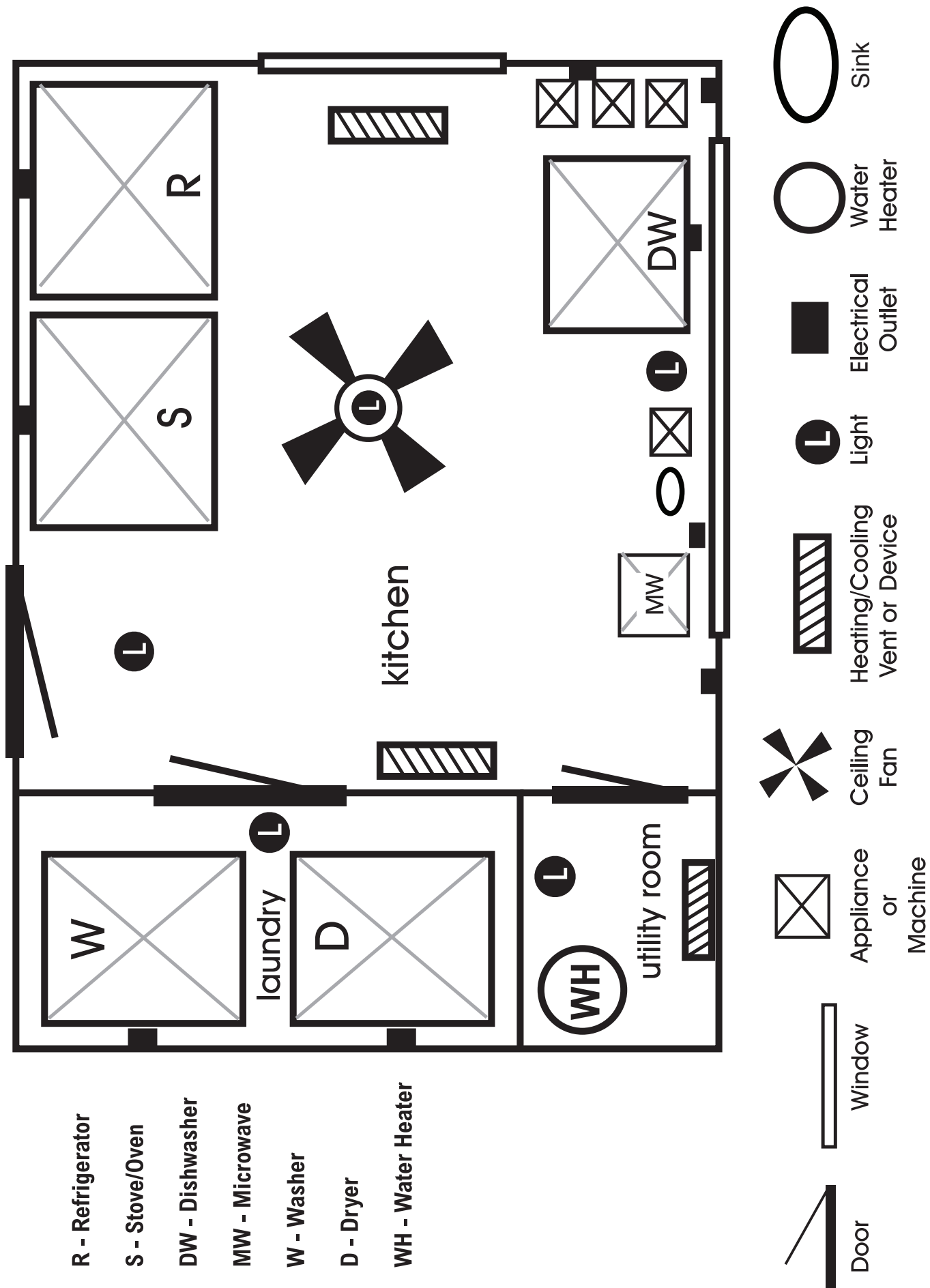
DW - Dishwasher

MW - Microwave

W - Washer

D - Dryer

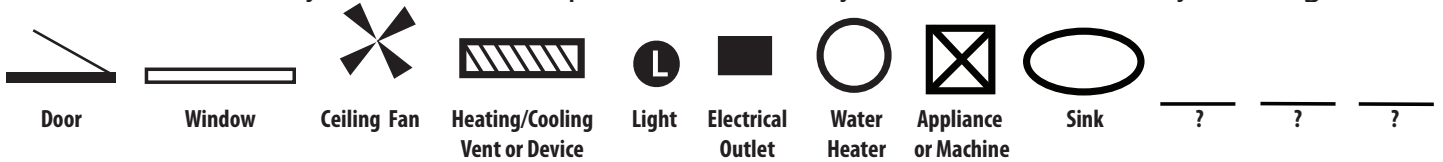
WH - Water Heater





Energy at Home 1

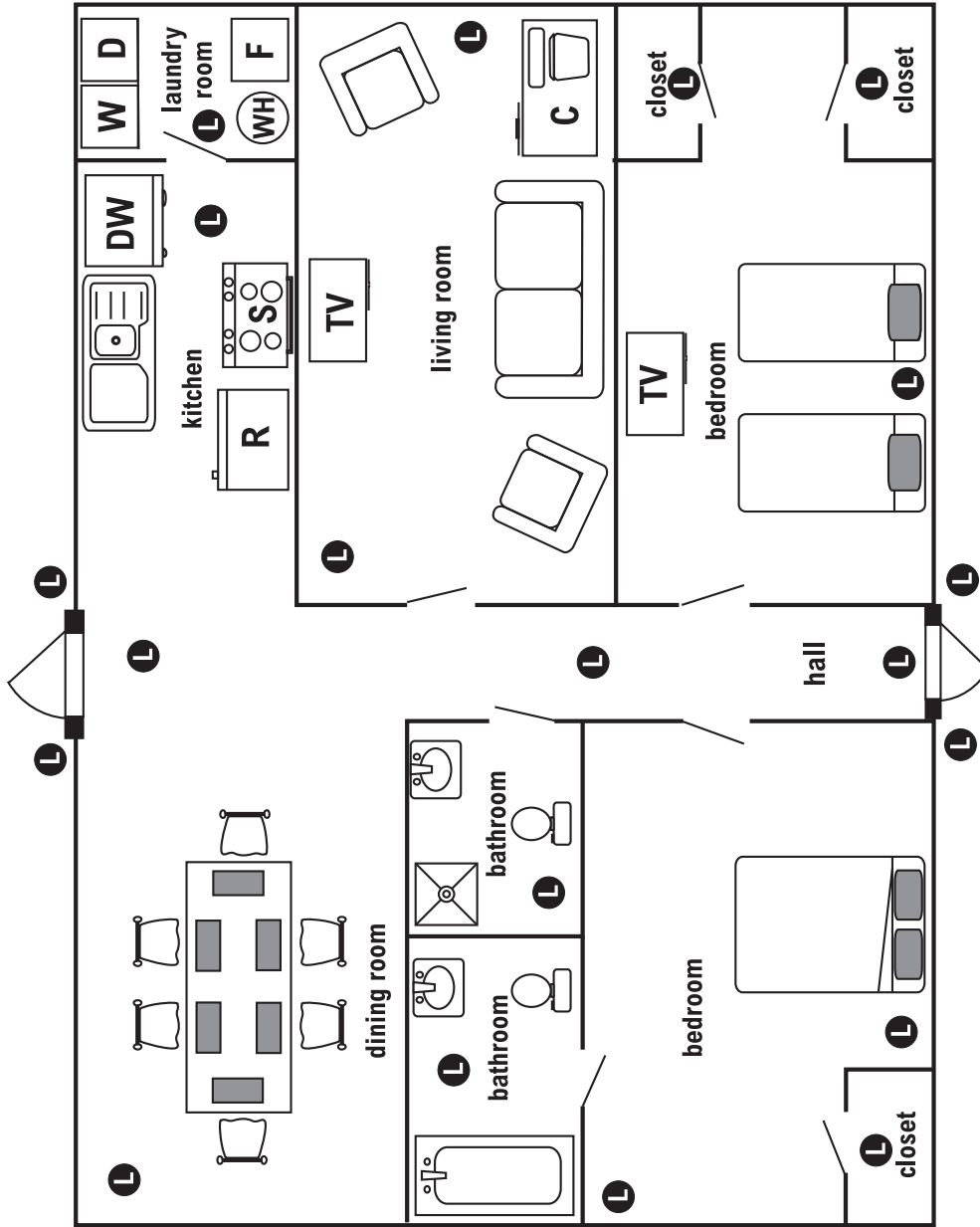
Look at the diagram on page 24. Draw a picture of your kitchen at home in the box below. Use the symbols and letters to show the appliances, lights, electrical outlets, heating and cooling devices and vents, ceiling fans, windows, and doors. If you have an energy user in your kitchen that is not in the key, use the blank spaces to make a symbol for it. Add it to your diagram.



My Kitchen



Energy at Home 2



R = Refrigerator

S = Stove

DW = Dishwasher

W = Washer

D = Dryer

WH = Water Heater

F = Furnace

C = Computer System

TV = Television

L = Light

1. How many people live here (count the bed pillows)? _____
2. How many indoor lights? _____ How many outdoor lights? _____
3. How many lights in all? _____
4. If the family uses CFL bulbs in their closets and bathrooms, what percentage of their home lights are energy efficient? _____
5. If the family decides to replace all the lights with CFL bulbs except outside lights, what percent of their home lights will not be energy efficient? _____
6. How many machines and appliances are there? _____
7. During the week, each person uses light for 3 hours a day. How many hours a day is light used during the week? _____ During the weekend, each person uses light for 4 hours a day. How many hours a day is light used during the weekend? _____ How many hours in a week is light being used total? _____
8. If two people take 20 gallon baths and two people take 10 gallon showers, how much water is used a day? _____ a week? _____
9. If the family uses around 1,000 kWh a month and pays \$0.10 a kWh, how much will they owe the utility company each month? _____
If the utility company increases the cost to \$0.15, how much more will they pay? _____



Glossary

biomass	any living material, or material that was once alive or came from a living organism; examples include crops, wood, animal wastes, trash, and aquatic plants
coal	a fossil fuel formed by the breakdown of plant material millions to hundreds of millions of years ago
compact fluorescent light bulb	a light bulb made from a gas that glows when heated; saves energy when used instead of an incandescent light bulb, (CFL)
composting	recycling soil, food wastes, and plant materials
electricity	electrons in motion
energy	the ability to do work, produce change, or move an object
energy sources	resources used to provide us with energy
geothermal	heat energy that is created by the Earth
hydropower	energy that comes from moving water
incandescent light bulb	a light bulb with a wire that glows when heated; wastes energy when used instead of CFL or LED
light emitting diode	an energy-efficient light bulb made from special elements that conduct electricity to create light, (LED)
natural gas	an odorless, colorless, tasteless, non-toxic, clean-burning fossil fuel; it is usually found in fossil fuel deposits and used as a fuel
nonrenewable	fuels that cannot be easily made or replenished; we can use up nonrenewable fuels; oil, natural gas, propane, coal, and uranium are nonrenewable fuels
petroleum	another name for oil or the products refined from oil; petroleum materials include diesel fuel, heating oil, etc.; petroleum also includes lease condensate, unfinished oils, and natural gas plant liquids
recycling	taking materials that are no longer useful and making a new product
renewable	fuels that can be easily made or replenished; we can never use up renewable fuels; types of renewable fuels are hydropower (water), solar, wind, geothermal, and biomass
wind	moving air



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Independent Petroleum Association of New Mexico
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Kentucky River Properties LLC
Kentucky Utilities Company
Kinder Morgan
Leidos
Linn County Rural Electric Cooperative
Llano Land and Exploration
Louisiana State University Cooperative Extension
Louisville Gas and Electric Company
Maine Energy Education Project
Massachusetts Division of Energy Resources
Michigan Oil and Gas Producers Education Foundation
Miller Energy
Mississippi Development Authority–Energy Division
Mojave Environmental Education Consortium
Mojave Unified School District
Montana Energy Education Council
NASA
National Association of State Energy Officials
National Fuel
National Grid
National Hydropower Association
National Ocean Industries Association
National Renewable Energy Laboratory
Nebraska Public Power District
New Mexico Oil Corporation
New Mexico Landman's Association
Nicor Gas – An AGL Resources Company
Northern Rivers Family Services
North Shore Gas
NRG Energy, Inc.
Offshore Energy Center
Offshore Technology Conference
Ohio Energy Project
Opterra Energy
Oxnard School District
Pacific Gas and Electric Company

Paxton Resources
PECO
Pecos Valley Energy Committee
Peoples Gas
Petroleum Equipment and Services Association
Phillips 66
PNM
Providence Public Schools
Read & Stevens, Inc.
Renewable Energy Alaska Project
Rhode Island Office of Energy Resources
River Parishes Community College
RiverQuest
Robert Armstrong
Roswell Geological Society
Salt River Project
Sandia National Laboratory
Saudi Aramco
Science Museum of Virginia
C.T. Seaver Trust
Shell
Shell Chemicals
Society of Petroleum Engineers
Society of Petroleum Engineers – Middle East, North Africa and South Asia
David Sorenson
Southern Company
Space Sciences Laboratory of the University of California Berkeley
Tennessee Department of Economic and Community Development–Energy Division
Tioga Energy
Toyota
Tri-State Generation and Transmission
TXU Energy
United States Energy Association
University of Georgia
United Way of Greater Philadelphia and Southern New Jersey
University of Nevada–Las Vegas, NV
University of North Carolina
University of Tennessee
University of Texas - Austin
University of Texas - Tyler
U.S. Department of Energy
U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy–Wind for Schools
U.S. Department of the Interior–Bureau of Land Management
U.S. Energy Information Administration
West Bay Exploration
West Virginia State University
Yates Petroleum Corporation