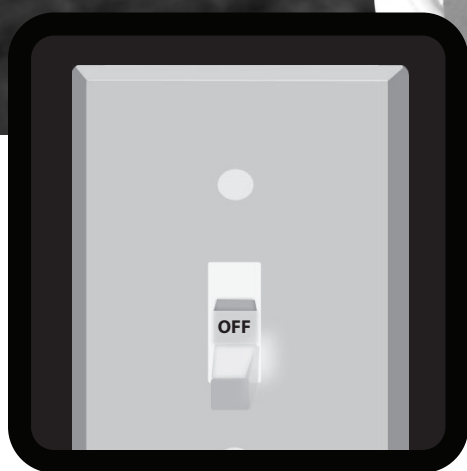
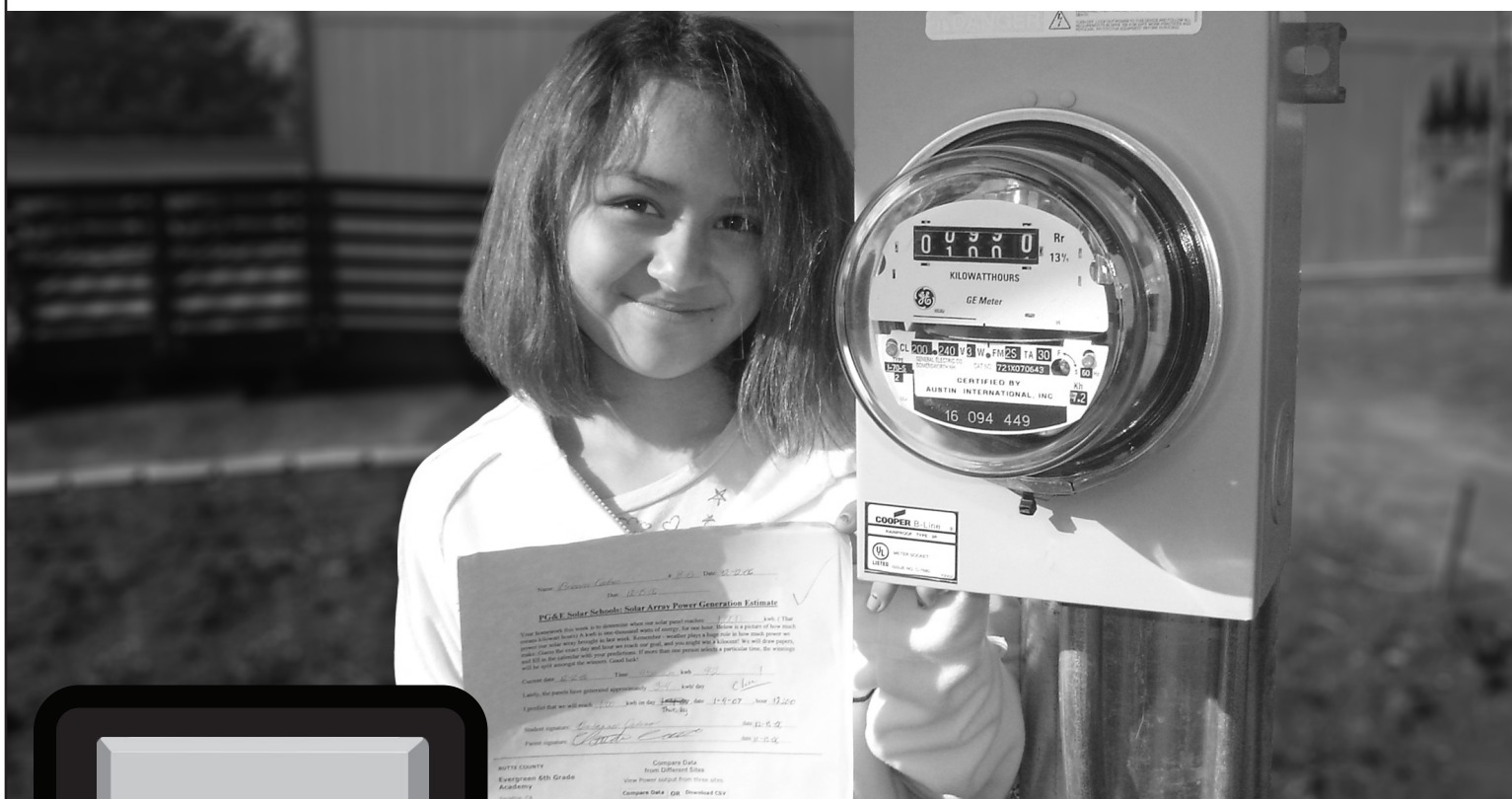


Saving Energy at Home and School Teacher Guide

2016-2017

Students explore energy sources, efficiency, and conservation with hands-on activities for the classroom and home environments. Each student receives a Home Energy Efficiency Kit that corresponds with the classroom lessons, and allows students to share what they have learned with their families.



Grade Levels:

Elem

Elementary

Int

Intermediate

Sec

Secondary

Subject Areas:



Science



Social Studies



Language Arts



Technology



Math



National Energy Education Development Project



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NEED Mission Statement

The mission of The NEED Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs.

Permission to Copy

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Teacher Advisory Board

In support of NEED, the national Teacher Advisory Board (TAB) is dedicated to developing and promoting standards-based energy curriculum and training.

Energy Data Used in NEED Materials

NEED believes in providing teachers and students with the most recently reported, available, and accurate energy data. Most statistics and data contained within this guide are derived from the U.S. Energy Information Administration. Data is compiled and updated annually where available. Where annual updates are not available, the most current, complete data year available at the time of updates is accessed and printed in NEED materials. To further research energy data, visit the EIA website at www.eia.gov.



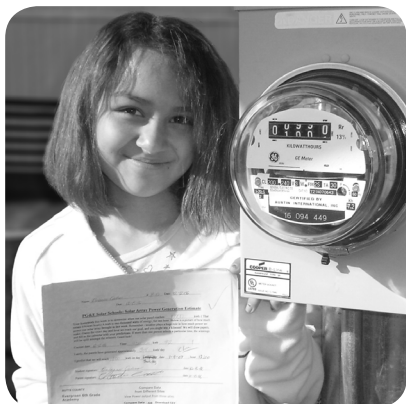
1.800.875.5029

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Saving Energy at Home and School Teacher Guide

Saving Energy Classroom Kit

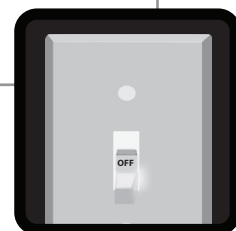
- 1 Incandescent bulb
- 1 Compact fluorescent light bulb (CFL)
- 1 Light emitting diode bulb (LED)
- 1 Kill A Watt® monitor
- 10 Radiation cans (5 sets of 2)
- 10 Lab thermometers
- 5 Sets of insulation materials
- 3 Student thermometers
- 1 Indoor/outdoor thermometer
- 1 Light meter
- 1 9-volt Battery (for light meter)
- 1 Flicker Checker
- 1 Waterproof digital thermometer
- 1 Digital humidity/temperature pen

Student and Family Home Energy Efficiency Kit

- Flow meter bag
- Hot water gauge
- Low flow showerhead
- Bathroom sink aerator
- Kitchen sink aerator
- Roll of teflon tape
- Outlet and switch plate gaskets
- Thermostat temperature guide
- Refrigerator thermometer
- 1 Light emitting diode bulb (LED)
- Nightlight
- Reply form

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Standards Correlation Information

www.NEED.org/curriculumcorrelations

Next Generation Science Standards

- This guide effectively supports many Next Generation Science Standards. This material can satisfy performance expectations, science and engineering practices, disciplinary core ideas, and cross cutting concepts within your required curriculum. For more details on these correlations, please visit NEED's curriculum correlations website.

Common Core State Standards

- This guide has been correlated to the Common Core State Standards in both language arts and mathematics. These correlations are broken down by grade level and guide title, and can be downloaded as a spreadsheet from the NEED curriculum correlations website.

Individual State Science Standards

- This guide has been correlated to each state's individual science standards. These correlations are broken down by grade level and guide title, and can be downloaded as a spreadsheet from the NEED website.



National Energy Education Development Project

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[Curriculum Correlations](#)

NEED has correlated their materials to the Disciplinary Core Ideas of the Next Generation Science Standards. NEED has also correlated all of their materials to The Common Core State Standards for English/Language Arts and Mathematics. All materials are also correlated to each state's individual science standards. Most files are in Excel format. NEED recommends downloading the file to your computer for use. Save resources, don't print!

- [Navigating the NGSS? We have What You NEED!](#)
- [NEED alignment to the Next Generation Science Standards](#)
- [Common Core State Standards for English and Language Arts](#)
- [Common Core Standards for Mathematics](#)
- [Alabama](#)
- [Alaska](#)
- [Arizona](#)
- [Arkansas](#)
- [California](#)



NEED is adding new energy workshops all the time. Want to



Message to the Teacher

Dear Educator:

This *Saving Energy at Home and School* program provides energy-related classroom materials that are correlated to the national and state standards and to local level guidelines. NEED's materials and programs have been reviewed by teachers for effectiveness, and are currently in use in schools across the country. The NEED curriculum assists teachers in meeting their energy standards and assists families and schools in efforts to reduce energy consumption.

The Home Energy Efficiency Kits that accompany this guide help students take the lessons they are learning in the classroom to their homes. The kits include items designed to help reduce electricity and natural gas use at home and give students and their families a chance to see how even small measures can make a substantial difference in reducing energy use.

In the classroom, you and your students together will use the Saving Energy Classroom Kit, and students and their families can apply classroom lessons with the Home Energy Efficiency Kit. Students will learn about heating and cooling, lighting, electricity, natural gas, and much more. They will learn about ways to make simple changes that can save valuable natural resources and money on their utility bills.

The worksheets in this Teacher Guide allow you to assess student activities and to provide us with data to compile regarding overall energy conservation behaviors. Encourage your students to complete and return the reply card in their Home Energy Efficiency Kits.

This guide also references the U.S. Department of Energy guide to energy savings, *Energy Saver*. This booklet is free for download and makes a great student/family reader supplement to the Student and Family Guide. Encourage students and families to download and read together. (See page 6 for more information.)

We are pleased you have chosen to participate in this exciting opportunity and encourage you to contact NEED with any questions you may have.



The NEED Project
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Unit Timeline and Overview

Three Weeks Before Start of Unit

- Determine the number of students who will participate.
- If you need additional materials, call NEED at 1-800-875-5029.

Two Weeks Before Start of Unit

- Familiarize yourself with the guides and the materials in the kits. See the materials needed on page 7 and the kit components list on page 3 for more information.
- Practice the experiments and investigations.

During Unit

- Administer the *Pre-Assessment* from the Student and Family Guide.
- Collect student work as directed in the Teacher Guide.

For Additional Support

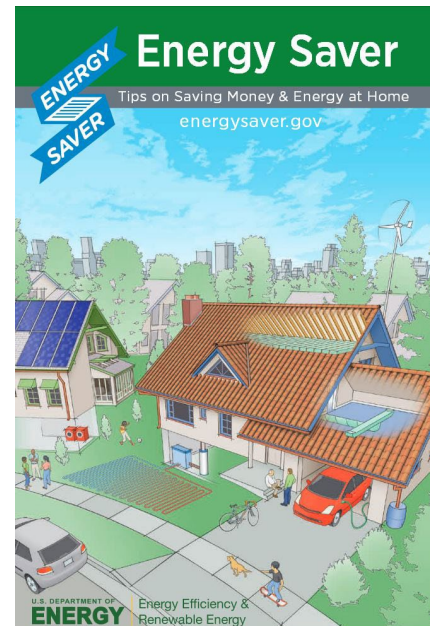
The *Energy Saver* guide, produced and distributed by the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy, makes an excellent supplement to the student activities and home applications. This guide is available for free download in PDF, MOBI, and EPUB formats and is updated frequently by the DOE. You may download a current copy of this guide by visiting www.energy.gov/energysaver/downloads/energy-saver-guide. Share the link with students and parents for reading at home in conjunction with home activities, or read the appropriate sections as a class. It may be helpful to project the guide pages used for each lesson or home activity.

End of Unit

- Collect student work as directed in the Teacher Guide.
- Administer the *Post-Assessment* from the Student and Family Guide. Return these with the *Pre-Assessment* to NEED to show us what your students have learned!
- Complete the unit *Evaluation Form* on page 59 as a class and return it to NEED.
- Allow students to take Student and Family Guides home after collecting any student work needed for assessment purposes.
- Encourage students' families to return the *Reply Form* in their Home Energy Efficiency Kits.

Assessment Answer Key

1. b 2. c 3. a 4. c 5. b 6. c 7. a 8. b 9. c 10. b 11. c 12. a 13. a 14. a 15. a





Saving Energy at Home and School Materials

ACTIVITY	MATERIALS INCLUDED	ADDITIONAL MATERIALS NEEDED
<i>Using Energy at School</i>		▪ Notebook paper ▪ Overhead or digital projector ▪ Pencils/markers ▪ Chart paper
<i>Insulation and Weatherization</i>	▪ 10 Radiation cans (5 sets of 2) ▪ 10 Lab thermometers ▪ Insulating materials	▪ Masking tape ▪ Hot water ▪ Rubber bands ▪ Timer or stopwatch ▪ Pitcher
<i>Heating and Cooling</i>	▪ Digital thermometer ▪ Digital humidity/temperature pen	
<i>Water Heating</i>	▪ Flow meter bag* ▪ Hot water gauge* ▪ Digital thermometer	
<i>Windows</i>		▪ Pencils ▪ Tape ▪ Tissue paper
<i>Lighting</i>	▪ Light meter (with battery) ▪ Student thermometer ▪ Flicker Checker ▪ CFL ▪ LED ▪ Incandescent light bulb	▪ 3 Lamps ▪ Textbooks
<i>Appliances and Machines</i>	▪ Kill A Watt™ monitor ▪ Refrigerator thermometer*	▪ Pluggable appliances

*Included in Student and Family Home Energy Efficiency Kit listed below.

Student and Family Home Energy Efficiency Kit

- Flow meter bag
- Hot water gauge
- Low flow showerhead
- Bathroom sink aerator
- Kitchen sink aerator
- Roll of teflon tape
- Outlet and switch plate gaskets
- Thermostat temperature guide
- Refrigerator thermometer
- 1 Light emitting diode bulb (LED)
- Nightlight
- Reply form



Lesson 1: Setting the Stage—What is Energy?

Overview

This lesson reviews the forms and sources of energy and the production of electricity. Depending on the prior knowledge of your students, you may want to spend additional time on these topics using the *Energy Infobooks* available at www.NEED.org on primary, elementary, intermediate, and secondary reading levels for your differentiated instruction needs.

Objectives

- Students will be able to list the forms of energy and cite examples of them in common items.
- Students will be able to list the ten sources of energy and classify each as renewable or nonrenewable.
- Students will be able to list ways in which each of the ten sources of energy are used.
- Students will be able to differentiate between energy efficiency and energy conservation, citing examples of each concept.

Masters

- *Forms of Energy (1-1)*, page 10
- *Where Does My Car Get Its Energy? (1-2)*, page 11
- *U.S. Energy Consumption By Source, 2014 (1-3)*, page 13
- *The Energy I Used Today (1-4)*, page 15
- *From Natural Gas to Electricity (1-5)*, page 16

Student and Family Guide

- *Forms of Energy*, page 12
- *Energy Source Matching*, page 13
- *Forms and Sources of Energy*, page 14
- *The Energy I Used Today*, pages 15-16
- *Transporting Electricity*, page 17
- *Efficiency vs. Conservation*, page 18
- *Reflections*, page 19
- *Connections*, page 20
- *Pre-Assessment*, page 80

✓ Procedure

1. Distribute one Student and Family Guide to each student. NEED's *Energy Infobooks* may also be helpful for each student (available at www.NEED.org).
2. Introduce the unit as a study of energy—what it is, where we get it, how we use it, and ways we can conserve it.
3. Go to the *Pre-Assessment* in the Student and Family Guide and have the students complete the page. Emphasize that it is an exercise to find out what the students know. It will not be graded, so the students should leave blank any questions they cannot answer. Tell the students that the assessment will give them an idea of the things they will be learning in the unit.
4. Instruct the students to remove the completed assessments from their Student and Family Guides. Collect and save them for evaluation.
5. Discuss with students that energy is the ability to do work.
6. List the major things energy does—**heat, light, sound, motion, growth, and powering technology**—as column headings on the board or in a digitally projected document and have the students give examples of each.
7. Review forms of energy using the *Forms of Energy (1-1)* master and the same sheet on page 12 of the Student and Family Guide.
8. Discuss where we get energy and list student responses for the class to see.
9. Display or project the *Where Does My Car Get Its Energy? (1-2)* master. Hide or cover all of the images except the car.
10. Ask, "Where does a car get the energy it needs to move?" When 'gas pump' is named, uncover the picture.

11. Ask, "What fuel is being used by the car?" When 'gasoline' or 'diesel' is named, uncover the picture of the barrel. Discuss petroleum products.
12. Ask, "Where is petroleum found?" Petroleum is found trapped in rock formations, deep beneath land and oceans.
13. Ask, "How was petroleum formed?" Uncover the formation pictures. Petroleum was formed when tiny sea plants and animals died, were buried on the oceans' floors and were compressed under heat and pressure over hundreds of millions of years, turning them into oil (petroleum) and natural gas.
14. Ask, "Where did the sea plants and animals get the energy that was stored in them?" Uncover the top picture. Plants absorbed radiant energy from the sun and stored it in their cells as chemical energy.
15. Discuss that this is an example of an energy flow. The energy from the petroleum (stored chemical energy) was used to provide energy for the car to move—motion energy.
16. Ask students to list other energy sources like petroleum and natural gas.
17. Review the meanings of renewable and nonrenewable.
18. Go to the *Energy Source Matching* worksheet in the Student and Family Guide. Instruct students to match each energy source with its definition. Review answers using the answer key on page 12 of the Teacher Guide.
19. Display or project the *U.S. Energy Consumption by Source, 2014 (1-3)* master.
20. Go to the *Forms and Sources of Energy* worksheet in the Student and Family Guide. Instruct students to complete the activity. Review using the answer key on page 14 of the Teacher Guide.
21. Discuss how we use energy and list student responses for the class to see.
22. Go to *The Energy I Used Today* worksheets in Student and Family Guide. Instruct the students to complete the activity by circling the energy activities or devices they used in the last 24 hours.
23. Display *The Energy I Used Today (1-4)* master. Have the students add the energy bucks they used to their lists and calculate their total energy bucks.
24. Discuss the total energy bucks students used. A total of under 40 is considered very good in terms of energy savings. Ask students which items they could cut out to reduce their use of energy.
25. Ask, "What is electricity? How is electricity produced?" List student responses for the class to see.
26. Display or project the *From Natural Gas to Electricity (1-5)* master and explain how natural gas produces electricity.
27. Discuss how electricity is produced by other energy sources in the U.S., such as other fossil fuels, uranium, hydropower, wind, solar, geothermal, and biomass. Discuss the energy sources used in your area to generate electricity.
28. Go to the electricity factsheet in the Infobook and have students use the factsheet to complete the *Transporting Electricity* activity in Student and Family Guide. Review answers using the answer key on page 17 of the Teacher Guide.
29. Ask students to explain the difference between efficiency and conservation. Record student ideas and discussion. Have students read page 4 in their Student and Family Guides and record definitions and examples for efficiency and conservation and answer the question at the bottom of the *Efficiency vs. Conservation* chart. Discuss the answers as a class and explain that these two terms will be the focus of the activities in this unit.
30. Have the students complete *Lesson 1: Reflections* and *Lesson 1: Connections* activities in the Student and Family Guide.



Forms of Energy

All forms of energy fall under two categories:



POTENTIAL

Stored energy and the energy of position (gravitational).

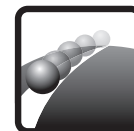


CHEMICAL ENERGY is the energy stored in the bonds between atoms in molecules. Gasoline and a piece of pizza are examples.

NUCLEAR ENERGY is the energy stored in the nucleus or center of an atom – the energy that holds the nucleus together. The energy in the nucleus of a plutonium atom is an example.

ELASTIC ENERGY is energy stored in objects by the application of force. Compressed springs and stretched rubber bands are examples.

GRAVITATIONAL POTENTIAL ENERGY is the energy of place or position. A child at the top of a slide is an example.



KINETIC

The motion of waves, electrons, atoms, molecules, and substances.



RADIANT ENERGY is electromagnetic energy that travels in transverse waves. Light and x-rays are examples.

THERMAL ENERGY or heat is the internal energy in substances – the vibration or movement of atoms and molecules in substances. The heat from a fire is an example.

MOTION is the movement of a substance from one place to another. Wind and moving water are examples.

SOUND is the movement of energy through substances in longitudinal waves. Echoes and music are examples.

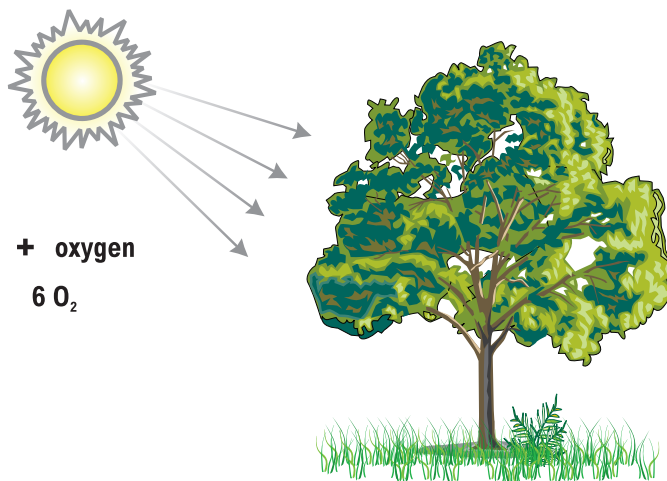
ELECTRICAL ENERGY is the movement of electrons. Lightning and electricity are examples.



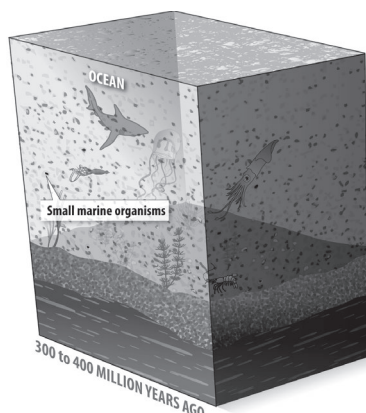
Where Does My Car Get Its Energy?

1 PHOTOSYNTHESIS

In the process of photosynthesis, plants convert radiant energy from the sun into chemical energy in the form of glucose (or sugar).

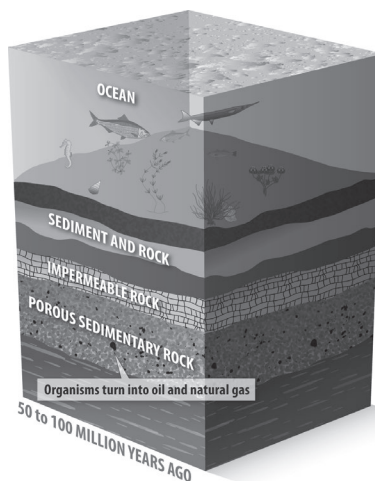


2



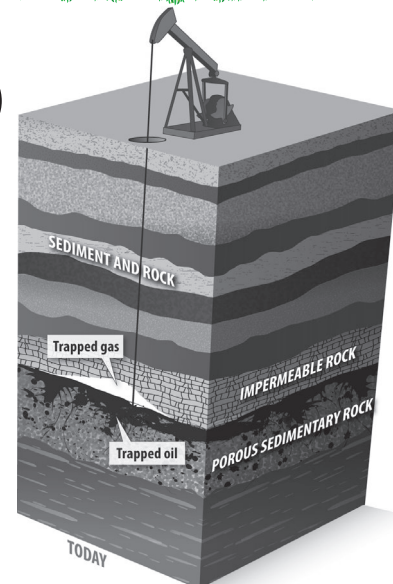
Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of sediment and rock.

3



Over hundreds of millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into petroleum and natural gas.

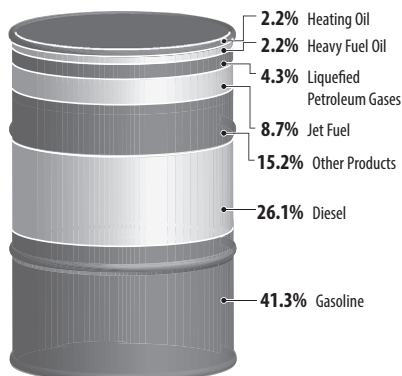
4



Today, we drill down through the layers of sedimentary rock to reach the rock formations that contain petroleum and natural gas deposits.

5

Products Produced From a Barrel of Oil, 2014



Data: Energy Information Administration

6



7





Energy Source Matching

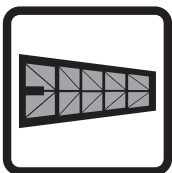
Write the number of the energy source on the line next to its definition.

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



U.S. Energy Consumption by Source, 2014

NONRENEWABLE



PETROLEUM 34.9%
Uses: transportation, manufacturing



NATURAL GAS 27.5%
Uses: heating, manufacturing, electricity



COAL 18.0%
Uses: electricity, manufacturing



URANIUM 8.3%
Uses: electricity

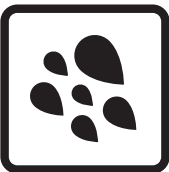


PROPANE 1.6%
Uses: heating, manufacturing

RENEWABLE



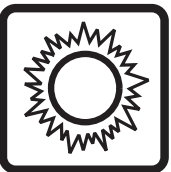
BIOMASS 4.8%
Uses: heating, electricity, transportation



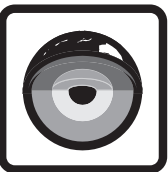
HYDROPOWER 2.5%
Uses: electricity



WIND 1.7%
Uses: electricity



SOLAR 0.4%
Uses: heating, electricity



GEOHERMAL 0.2%
Uses: heating, electricity

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



Forms and Sources of Energy

In the United States we use a variety of resources to meet our energy needs. Use the information below to analyze how each energy source is stored and delivered.

- 1 Using the information from the *Forms of Energy* chart and the graphic below, determine how energy is stored or delivered in each of the sources of energy. Remember, if the source of energy must be burned, the energy is stored as chemical energy.

NONRENEWABLE

Petroleum	<u>CHEMICAL</u>
Coal	<u>CHEMICAL</u>
Natural Gas	<u>CHEMICAL</u>
Uranium	<u>NUCLEAR</u>
Propane	<u>CHEMICAL</u>

RENEWABLE

Biomass	<u>CHEMICAL</u>
Hydropower	<u>MOTION</u>
Wind	<u>MOTION</u>
Solar	<u>RADIANT</u>
Geothermal	<u>THERMAL</u>

- 2 Look at the U.S. Energy Consumption by Source graphic below and calculate the percentage of the nation's energy use that each form of energy provides.

What percentage of the nation's energy is provided by each form of energy?

Chemical	<u>86.8%</u>
Nuclear	<u>8.3%</u>
Motion	<u>4.2%</u>
Thermal	<u>0.2%</u>
Radiant	<u>0.4%</u>

What percentage of the nation's energy is provided

By nonrenewables? 90.3%

By renewables? 9.6%

U.S. Energy Consumption by Source, 2014

NONRENEWABLE

	PETROLEUM 34.9%	Uses: transportation, manufacturing
	NATURAL GAS 27.5%	Uses: heating, manufacturing, electricity
	COAL 18.0%	Uses: electricity, manufacturing
	URANIUM 8.3%	Uses: electricity
	PROPANE 1.6%	Uses: heating, manufacturing

RENEWABLE

	BIOMASS 4.8%	Uses: heating, electricity, transportation
	HYDROPOWER 2.5%	Uses: electricity
	WIND 1.7%	Uses: electricity
	SOLAR 0.4%	Uses: heating, electricity
	GEOTHERMAL 0.2%	Uses: heating, electricity

*Total does not add to 100% due to independent rounding.

Data: Energy Information Administration



The Energy I Used Today

Energy Buck Values

Waking Up

Alarm Clock or Radio.....2

Breakfast

Microwave.....2

Stove/Oven.....5

Toaster Oven/Toaster.....3

Refrigerator.....3

Ready for School

Air Conditioning/Heating.....10

Radio/CD Player/MP3 Player/iPod.....2

TV/DVD Player.....3

Gaming System.....3

Shower/Bath.....3

Hair Dryer.....3

Curling Iron/Curlers/Flat Iron.....3

Telephone/Cell Phone.....2

Computer.....3

iPad/Tablet.....2

Room Lighting

Bedroom.....2

Bathroom.....2

Kitchen.....2

Family Room.....2

Other.....2

Getting to School

Walk.....0

Bicycle.....0

School Bus.....1

Carpool.....2

Family Vehicle.....5

After School

Air Conditioning/Heating.....10

Travel in Vehicle.....5

Lights.....2

Computer.....3

iPad/Tablet.....2

Gaming System.....3

Radio/CD Player/MP3 Player/iPod.....2

TV/DVD Player.....3

Telephone/Cell Phone.....2

Snack Preparation.....2

Last Night

Air Conditioning/Heating.....10

Microwave.....2

Stove/Oven.....5

Toaster Oven/Toaster.....3

Refrigerator.....3

Grill.....2

Lights.....2

TV/DVD Player.....3

Gaming System.....3

Shower/Bath.....3

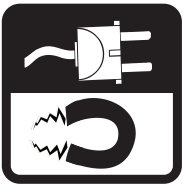
Hair Dryer.....3

Telephone/Cell Phone.....2

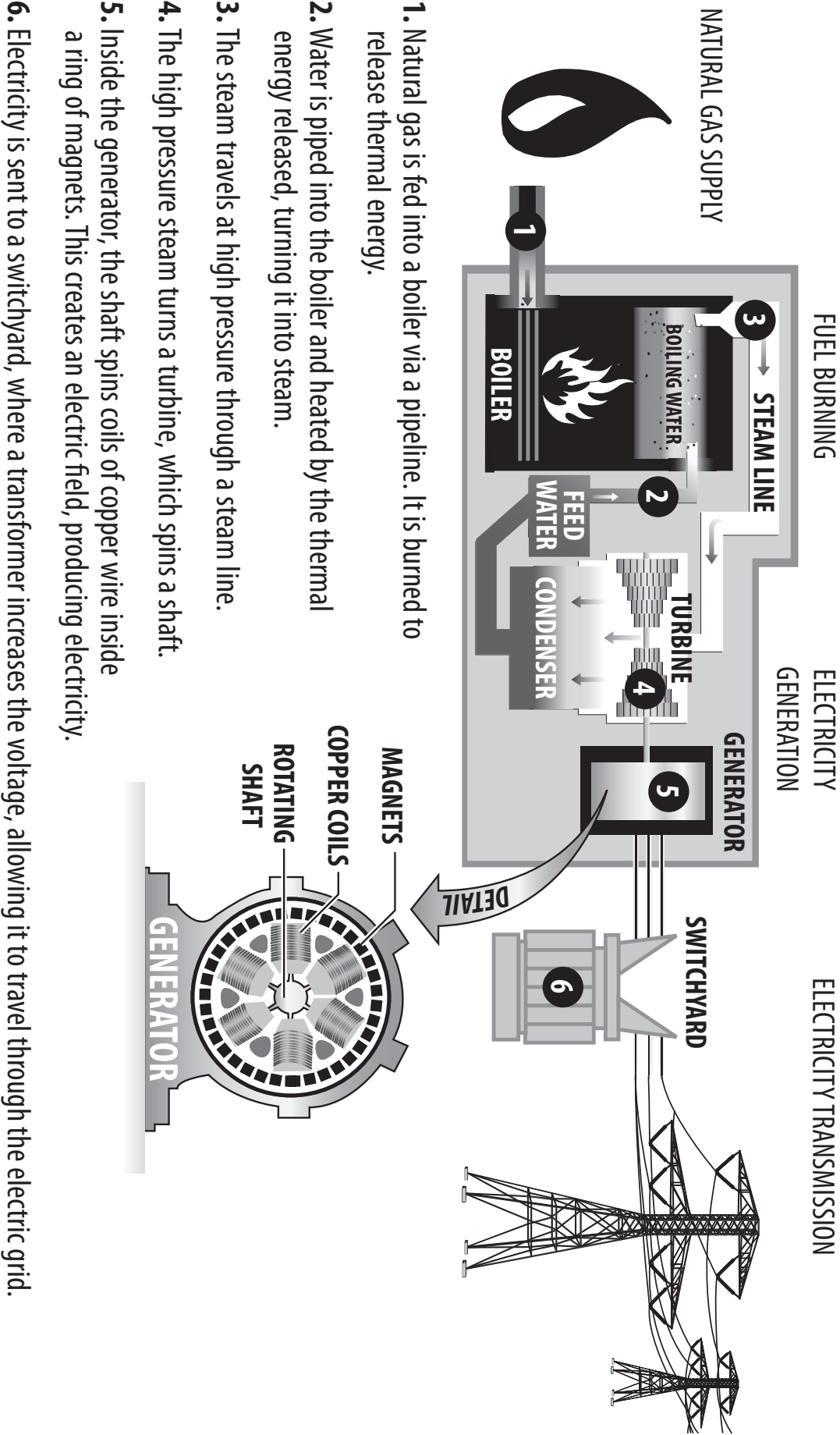
Computer.....3

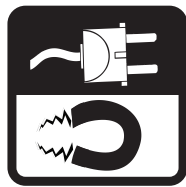
iPad/Tablet.....2

Radio/CD Player/MP3 Player/iPod.....2



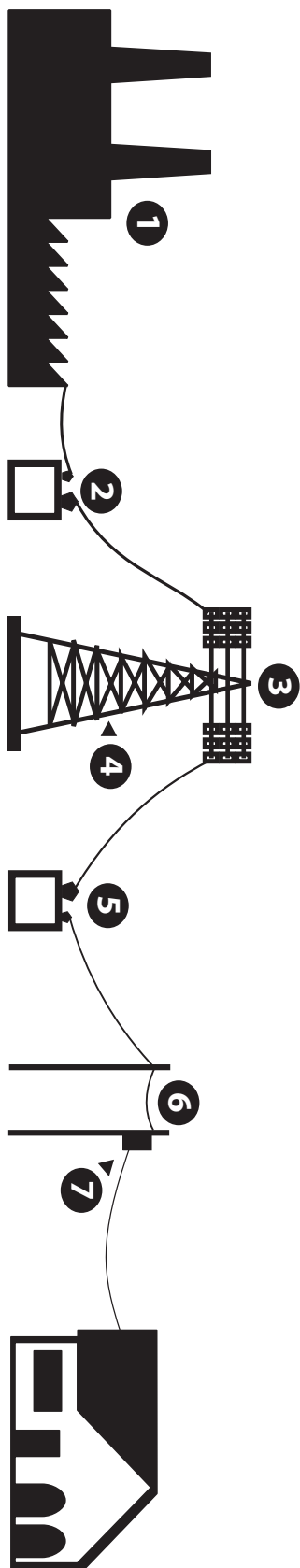
From Natural Gas to Electricity





Transporting Electricity

Explain what each of the components numbered below does to get electricity from the generator to the consumer.



- 1. Power plant:** generates electricity
- 2. Step-up transformer:** increases voltage to reduce transmission loss
- 3. Transmission line:** transports high-voltage electricity over long distances
- 4. Power tower:** holds or carries transmission lines
- 5. Step-down transformer:** lowers voltage for smaller distribution lines
- 6. Distribution line:** carries lower voltage electricity to homes and businesses
- 7. Neighborhood transformer:** lowers voltage to the voltage used by appliances in homes and businesses (120 and 240 volts)



Lesson 2: Using Energy at School

Overview

In this lesson, students investigate how energy is used at school.

Objectives

- Students will be able to identify several energy consumers in the building.
- Students will be able to differentiate between energy efficiency and energy conservation, citing examples of each concept.

Materials

- Digital projector or overhead
- Notebook paper
- Pencils/markers
- Chart paper

Masters

- *Legend (2-1)*, page 20
- *Blank Grid (2-2)*, page 21
- *Kitchen Example (2-3)*, page 22
- *Building Inventory (2-4)*, page 23

Student and Family Guide

- *Student Informational Text*, pages 4-11
- *Using Energy at School, My School, My Classroom, and My Work Area*, pages 21-24
- *Reflections*, page 25

Preparation

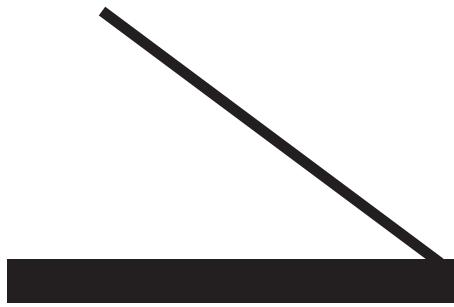
- Prior to the lesson, obtain permission for the students to investigate their assigned work areas throughout your school building.
- Make several copies of the *Legend* master and post around the room so all students can see them.
- Divide the class into four work area teams. Assign each team to one of the following areas: library, main office, gymnasium, and cafeteria.

✓ Procedure

1. Introduce the idea that energy is usually the second largest expense in school districts after personnel costs.
2. Ask students to brainstorm how they think schools use energy.
3. List student responses for the class to see. Make sure their examples include transportation, heating and cooling, lighting, cooking food, heating water, and running machines. Direct students to read the informational text in the Student and Family Guide.
4. Discuss the factors that affect the amount of energy schools use. Make sure to discuss the size of the building; the number and efficiency of windows and doors; the number and types of lights; the number of machines and how energy efficient they are; the efficiency and temperature settings of the heating, cooling, and water heating systems; the number of transportation vehicles, what fuels they use, and how far they travel; how well systems are maintained; and how people in the building manage all of these factors.
5. Introduce the activities that students will be doing to investigate their school building and how their school uses energy—drawing diagrams of the school building, their classroom, and their work areas.
6. Do the activity with notebook paper and pencils. Have the students walk around the outside of the school building with supervision, making sketches of the shape of the building and the placement of doors and windows. Return to the classroom when students have a good idea of the building's shape and design.
7. Display or project the *Legend (2-1)* master and explain the symbols.

8. Display or project the *Blank Grid (2-2)* master and draw a simple diagram of the school building using the symbols for doors and windows.
9. Discuss with the students what is accurate/inaccurate about your diagram, making changes until there is a consensus that the diagram is an accurate depiction of the school building.
10. Go to the *Using Energy at School* worksheet in the Student and Family Guide. Have the students read the instructions, examine the example, then draw their own diagrams of the school on page 22 of the Student and Family Guide. Instruct them to leave enough room around the outside of the diagram to add landscaping later.
11. Display the *Kitchen Example (2-3)* master. Indicate the symbols used to represent doors, windows, electrical outlets, lights, and energy-consuming appliances and devices. Display or pass out copies of the *Legend (2-1)*, and direct students to page 29 in the Student and Family Guide showing the symbols.
12. Go to page 23 of the Student and Family Guide and have the students make their diagrams of the classroom, following the instructions to make sketches first on notebook paper.
13. Draw a basic outline/diagram of your school building on the board, interactive board, or overhead for student reference.
14. Label the main office, cafeteria, gymnasium, library, and your classroom.
15. Add a map legend and compass rose to your diagram.
16. Instruct the students to locate each of the items contained in the legend in their classroom. Using the symbols on the legend, have student volunteers add these items to the diagram.
17. Give each team of students a large sheet of chart paper and ten markers, one color for each item on the map legend. Have each team choose a team leader. The team leader will be responsible for drawing the outline of their assigned location. Each team member will be assigned one or more items from the map legend. The team leader will monitor and assist as needed.
18. Discuss with the students the appropriate behavior for this assignment: no talking in the hallway; no running at any time; work cooperatively; do not disrupt any activity in your assigned location.
19. Student teams will go to their assigned locations and complete the diagram for that location.
20. Once the students have completed their inventory and diagrams, teams will return to the classroom and review what they found.
21. Go to page 24 of the Student and Family Guide, *My Work Area*, and have students draw their diagrams in their work groups.
22. Go to the *Reflections* activity in the Student and Family Guide, and have the students complete the questions at the top of the page.
23. Project or display the *Building Inventory (2-4)* master. Fill in the chart with data (numbers, locations, or important notes) from the work groups as the students complete their charts on the bottom of the *Reflections* activity.
24. Discuss what the students learned while completing the diagrams.

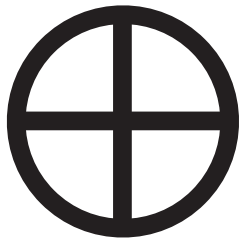
LEGEND



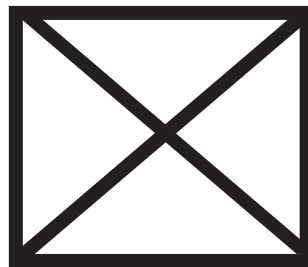
Door



Window

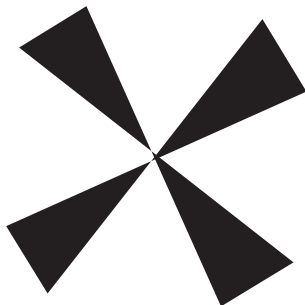


Light



Appliance or
Electrical Device

R - Refrigerator
S - Stove/Oven
DW - Dishwasher
MW - Microwave
W - Washer
D - Dryer



Ceiling Fan



Heating or
Cooling Device
or Vent



Utility Meter



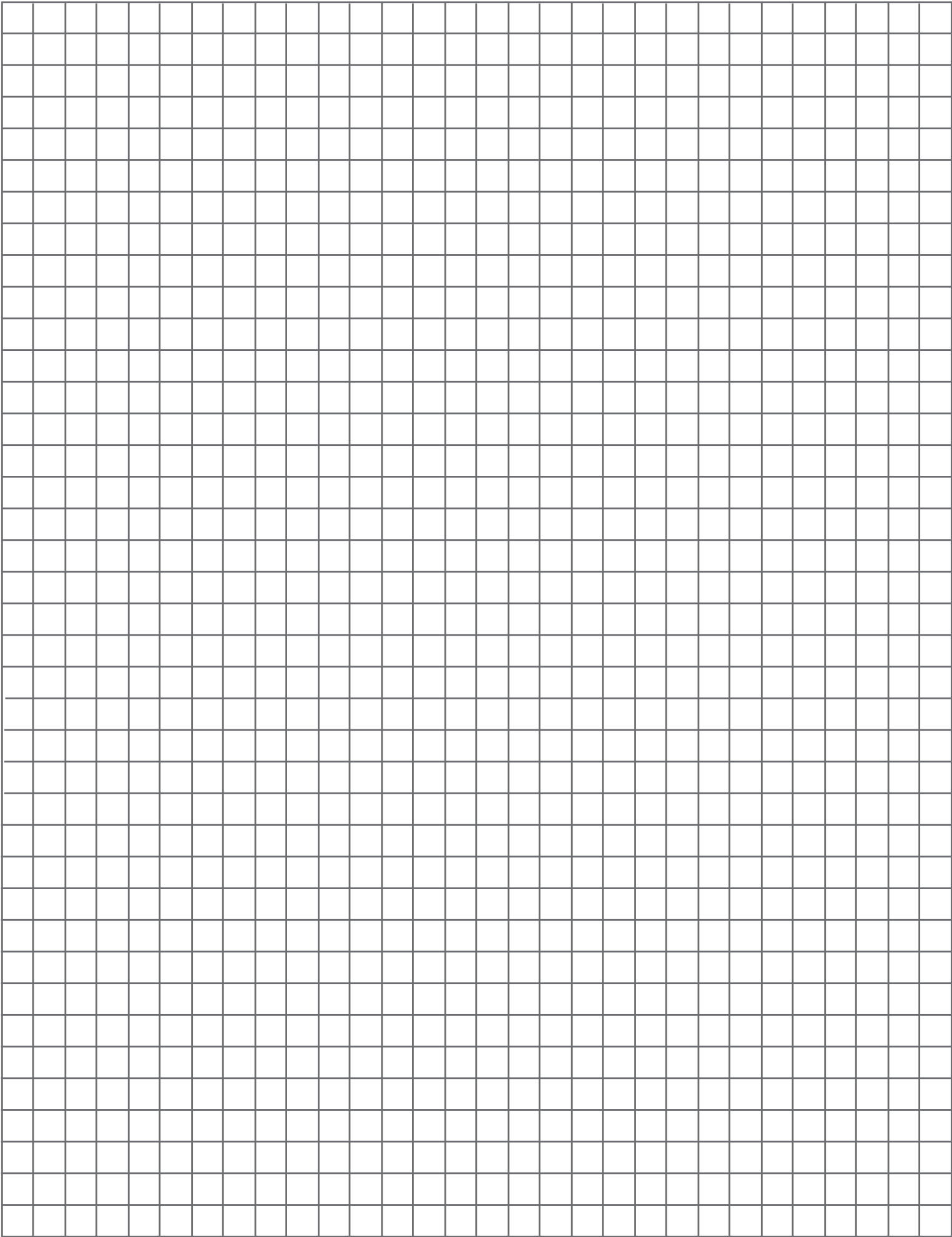
Thermostat

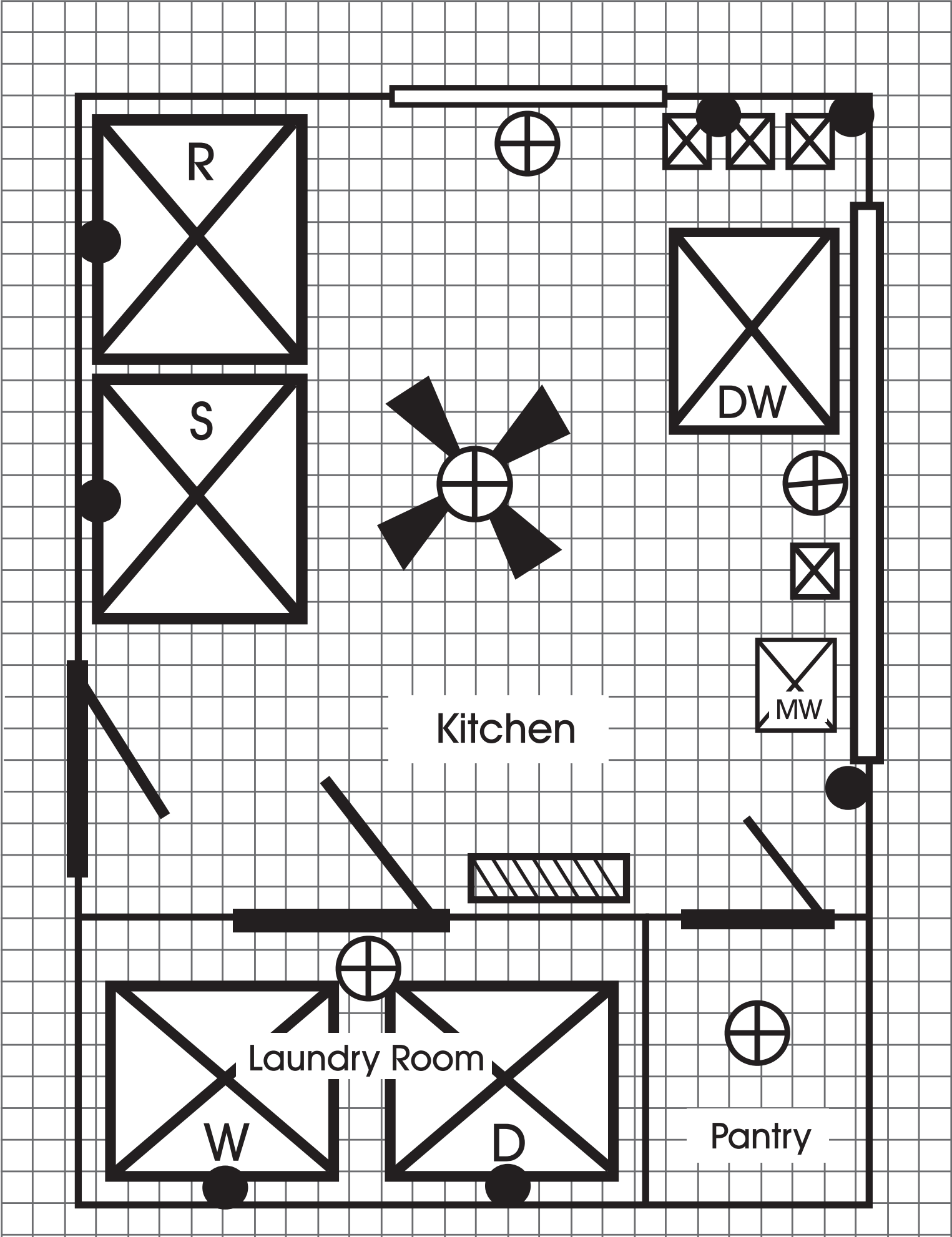


Water Heater



Electrical Outlet







Building Inventory

LOCATION	DOORS	WINDOWS	LIGHTS	ELECTRICAL DEVICES	HEATING/COOLING DEVICES/VENTS	ELECTRICAL OUTLETS	OTHER
BUILDING							
CLASSROOM							
OFFICE							
LIBRARY							
CAFETERIA							
GYMNASIUM							



Lesson 3: Using Energy at Home

Overview

In this lesson, students investigate how energy is used at home.

Objectives

- Students will be able to identify several energy consumers in the home.
- Students will be able to differentiate between energy efficiency and energy conservation, citing examples of each concept.

Master

- Energy Use at Home and School (3-1)*, page 25

Student and Family Guide

- Home Activity 1*, pages 26-28
- Home Activity 2*, pages 29-31
- Reflections*, page 32
- Connections*, page 33

Energy Saver Guide (see page 6 for more information)

- Pages 4-6

✓ Procedure

1. Introduce the activities the students will be completing at home.
2. Discuss how energy use at home is the same as energy use at school. How is it different? Use or display *Energy Use at Home and School (3-1)* master for students to brainstorm individually or in small groups.
3. List examples of student responses for the class to see.
4. As a class, discuss *Home Activity 1* and *2* in the Student and Family Guides, reviewing the items students will complete with their families.
5. Go to and display pages 4-6 of the *Energy Saver* guide and review the information as a class. Ask students to read with their families, if able, once at home.
6. Assign the activities and readings to the students and give them a completion date. Completing the assignment over a weekend may be more satisfactory than over one evening.
7. Remind students to take home their Student and Family Guides and to bring them back on the completion date.

✓ Procedure After Students Complete and Return the Activities

1. Go to *Home Activity 1* and *2* in the Student and Family Guide.
2. Discuss with the students the things they learned by doing the activities with their families and their families' responses to the activities.
3. Have the students complete the *Lesson 3: Reflections* and *Lesson 3: Connections* activities in the Student and Family Guide.
4. Discuss with students how their responses might compare with the class.

Extension

Have the class compile data from *Lesson 3: Reflections*, and have students calculate the mean number of a certain item, such as light bulbs. Depending on the age of your students, you may also have them solve for other statistical data such as the range, mode, or median.



Energy Use at Home and School

How is energy use at home the same as energy use at school?

How is energy use at home different from energy use at school?

HOME	SCHOOL



Lesson 4: Measuring the Energy We Use

Overview

This lesson will help students understand how electricity and natural gas consumption are measured and teach them how to read utility meters.

Objective

- Students will be able to read a utility meter and calculate consumption costs over time using appropriate units and rates.

Masters

- Reading an Electric Meter (4-1)*, page 28
- Reading a Natural Gas Meter (4-2)*, page 29
- School Utility Meters (4-3)*, page 30

Student and Family Guide

- Reading an Electric Meter*, page 34
- Reading a Natural Gas Meter*, page 35
- School Utility Meters*, page 36
- Home Activity 1*, page 37
- Home Activity 2*, page 38
- Reflections*, page 39
- Connections*, page 40

Preparation

- Schedule someone from the maintenance or facilities staff to accompany your students as they observe the school's electric and natural gas meters.
- Find out the average cost of a kilowatt-hour of electricity and a Ccf of natural gas for residential and commercial customers using information from local utility companies. Use this data when calculating the cost in the activities for this lesson and future lessons.

✓ Procedure

- Introduce the activity by discussing how different types of energy are measured.
- Ask (or explain), "What unit is used to measure the amount of gasoline we buy at a gas station?" (Gallon) "What devices measure the electricity and/or natural gas we use at school?" (Meters) "What unit of measurement is used to measure electricity?" (Kilowatt-hour) "What unit of measurement is used to measure natural gas?" (Ccf - Hundred cubic feet)
- Display the *Reading an Electric Meter (4-1)* master. Explain how to read an electric meter, how to determine the amount of electricity used over time, and how to calculate the cost. (The national average for residential customers is \$0.125/kWh and \$0.10/kWh for commercial customers.)
- Go to the *Reading an Electric Meter* worksheet in the Student and Family Guide. Instruct the students to complete the worksheet as you explain using the master. (See page 27 for answers.)
- Display the *Reading a Natural Gas Meter (4-2)* master. Explain how to read a natural gas meter, how to determine the volume of natural gas used over time, and how to calculate the cost. (The national average for residential customers is \$1.10/Ccf and \$0.89/Ccf for commercial customers.) Meters measure the volume of natural gas used in Ccf (hundred cubic feet), but utilities bill by therms—a measure of the amount of heat energy contained in the natural gas. One Ccf of natural gas contains approximately one therm (1.030 therms) of energy. Larger consumers, such as industrial users, measure volume in Mcf (thousand cubic feet).
- Go to the *Reading a Natural Gas Meter* worksheet in the Student and Family Guide. Instruct the students to complete the form as you explain using the master. (See page 27 for answers.)
- Go to the *School Utility Meters* worksheet in the Student and Family Guide if your school's meters have dials. If your school has digital meters, adjust the discussion accordingly. Instruct the students to take their guides and pencils with them to view the school's meters.

8. Have a member of the maintenance or facilities staff accompany the students to view the school's meters. Instruct the students to observe the spinning of the meter dials and record the readings on the meters.
9. Display the *School Utility Meters (4-3)* master and complete the meter faces with the readings from the students.
10. Ask if we use more energy in the building, will the dials spin slower or faster?
11. Go to *Home Activities 1* and *2* in the Student and Family Guide and review the activities with the students.
12. Assign the activities to the students and give them a completion date. The assignment may need to be modified for students who live in apartment buildings or other structures that do not have individual meters. Students without meters can use the information from students who have meters. Students without meters can also be assigned to research and explain how electricity and natural gas are metered in their living situations, as well as how the costs are prorated and billed.
13. Remind students to take home their Student and Family Guides and to bring them back on the completion date.

✓ Procedure After Students Complete and Return the Activities

1. Discuss the activities with the students, comparing usage and answering any questions.
2. Have the students complete the *Lesson 4: Reflections* and *Lesson 4: Connections* activities in the Student and Family Guide.
3. Measure the amount of electricity used at school for a one-hour period at the same time every day for a week.

Extension

Have a "no power hour" for the entire school, measure the electricity used, and compare to the results above.

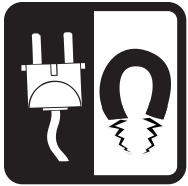
Reading Meters Answer Keys

READING AN ELECTRIC METER | STUDENT AND FAMILY GUIDE PAGE 34

January 1 = **26,010 kWh**
January 31 = **43,472 kWh**
17,462 kWh x \$0.10/kWh = **\$1,746.20**

READING A NATURAL GAS METER | STUDENT AND FAMILY GUIDE PAGE 35

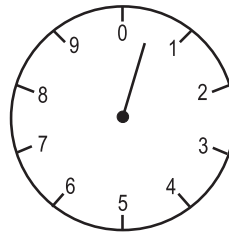
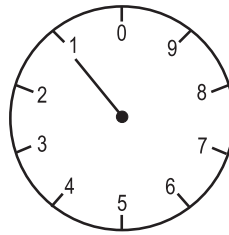
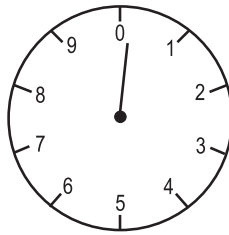
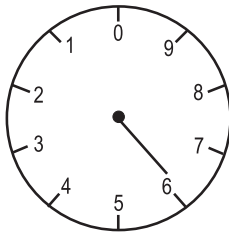
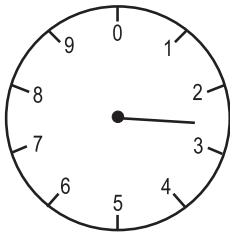
January 1 = **3,528 Ccf**
January 31 = **6,152 Ccf**
2,624 Ccf x \$0.89/Ccf = **\$2,335.36**



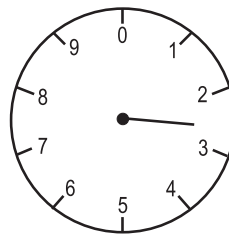
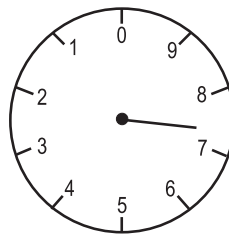
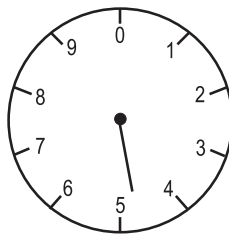
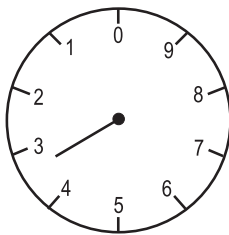
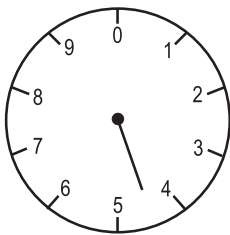
Reading an Electric Meter

The meters below show the readings for the first and last days of January. See if you can determine how much electricity was used during the month. Read the meter dials and record the numbers on the lines below the dials. If the pointer is between two numbers, **always** record the **smaller number**.

On January 1, the electric meter looked like this at school:



On January 31, the electric meter looked like this at school:



Electricity is measured in kilowatt-hours (kWh). One kWh is measured as one kilowatt (1,000 watts) of power consumed for one hour.

How much electricity was used in January at school? Let's find out. Subtract the January 1 reading from the January 31 reading to find the kilowatt-hours of electricity that were used during January.

January 31 reading = _____

January 1 reading = - _____

Electricity used = _____ **kWh**

If the power company charges \$0.10 for every kilowatt-hour of electricity that is used (the national average for **commercial customers** in 2014), what is the cost of the electricity that was used in January? Let's find out. Multiply the kilowatt-hours of electricity used by the cost per kilowatt-hour.

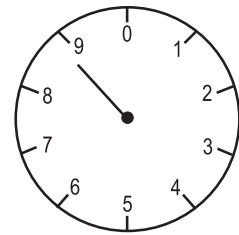
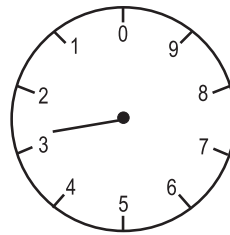
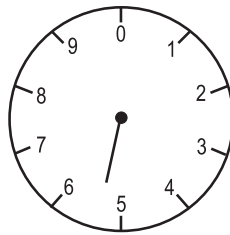
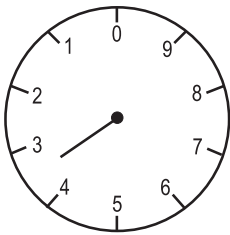
_____ kWh X \$0.10/kWh = \$ _____



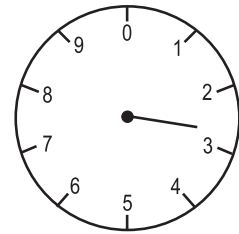
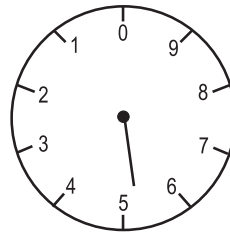
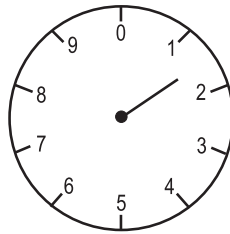
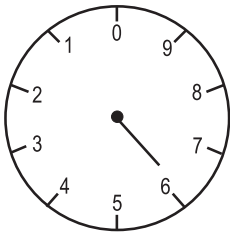
Reading a Natural Gas Meter

The natural gas meters below show the readings for the first and last days of January. See if you can determine how much natural gas was used during the month. Read the meter dials and record the numbers on the lines below the dials. If the pointer is between two numbers, **always record the smaller number**.

On January 1, the natural gas meter looked like this at school:



On January 31, the natural gas meter looked like this at school:



Natural gas is measured in cubic feet (cf), a measure of its volume—how much space it occupies. A cubic foot of natural gas is a small amount of fuel, so most gas meters measure natural gas in hundreds of cubic feet—or Ccf. The first C means one hundred (from the Roman numbering system).

$$100 \text{ cubic feet} = 100 \text{ cf} = 1 \text{ Ccf}$$

How much natural gas was used in January at school? Let's find out. Subtract the January 1 reading from the January 31 reading to find the volume of natural gas that was used during January.

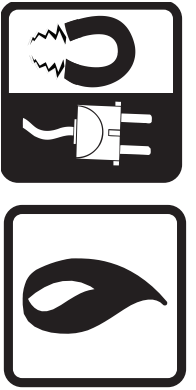
January 31 reading = _____

January 1 reading = _____

Natural gas used = _____ **Ccf**

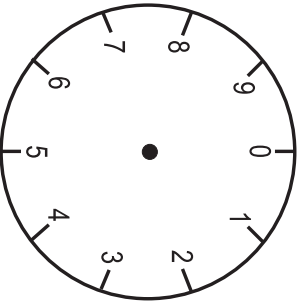
The meter measures the natural gas in Ccf, but the natural gas company charges by the amount of heat energy the gas contains. Heat energy is measured in therms. One Ccf of natural gas contains about one therm of heat energy (1.030 therms). If the gas company charges \$0.89 for a Ccf of gas (the national average for **commercial customers** in 2014), how much did the gas cost in January?

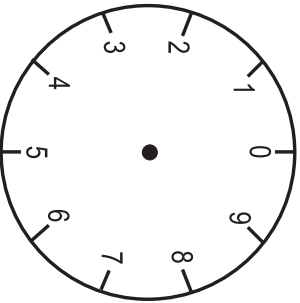
Usage charge: _____ **Ccf** X **\$0.89/Ccf** = \$ _____

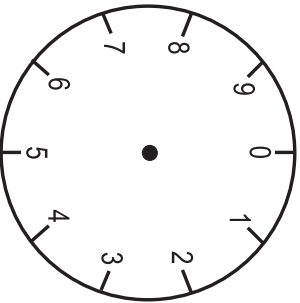


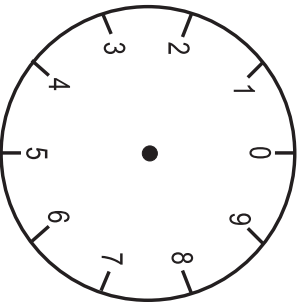
School Utility Meters

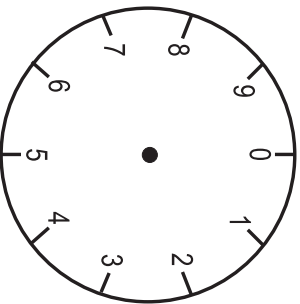
SCHOOL ELECTRIC METER



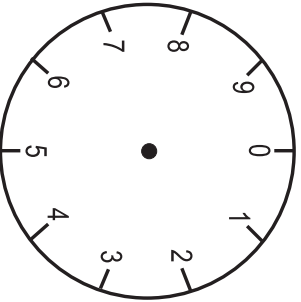


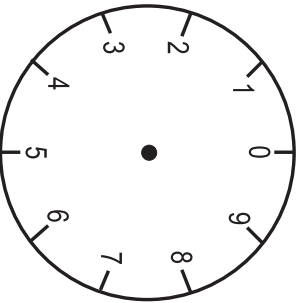


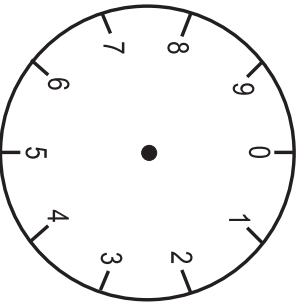


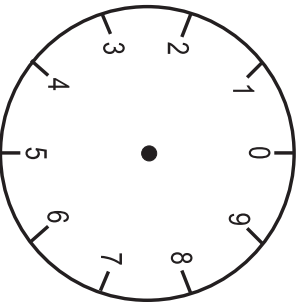


SCHOOL NATURAL GAS METER











Lesson 5: Insulation and Weatherization

Overview

This lesson helps students understand the importance of insulation in reducing energy consumption. Students will learn how to reduce air infiltration using simple, energy saving measures.

Objectives

- Students will be able to identify a material as a good or poor insulator.
- Students will be able to explain the importance of proper levels and placement of insulative materials.

Materials

- 10 Radiation cans (5 sets of 2)
- 10 Lab thermometers
- Pitcher
- Insulating materials
- 10 Rubber bands
- Timer
- Hot water (50-65°C)
- 5 Rolls of masking tape

Master

- Insulation Results (5-1)*, page 33

Student and Family Guide

- Insulation Investigation*, page 41
- Home Activity*, page 42
- Reflections*, page 43
- Connections*, page 44

Energy Saver Guide (see page 6 for more information)

- Pages 5, 7-11

Home Energy Efficiency Kit Materials

- Outlet and switchplate gaskets

Preparation

- Prepare by setting up five lab stations—each with 2 radiation cans of the same color, 2 thermometers, 2 rubber bands, one of the insulating materials, and tape. Make sure you have a source for hot water, a pitcher to dispense it, and a timer.

✓ Procedure

1. Introduce the topic by explaining the concepts of insulation, air infiltration, and weatherization, and why they are important to energy conservation.
2. Go to and project page 7 of the *Energy Saver* guide, and discuss places air can leak in the home or school.
3. Using the diagram on page 7, discuss the areas of a home that should be insulated.
4. Go to the *Insulation Investigation* in the Student and Family Guide. Review the procedure with the students.
5. Assign each work group to a lab station. New groups may be created, or students can remain in their groups from earlier activities.
6. Discuss the different insulating materials they will be investigating and have each group hypothesize which materials are the best insulators. Groups should rank the materials from 1 to 5 with 1 being the best insulator.
7. List the groups' hypotheses on the board.
8. Instruct the groups to insulate the sides of one of their cans with the materials they have been provided.

9. Fill all of the cans with exactly the same amount of hot water (approximately two-thirds full), and instruct the students to replace the tops and insert the thermometers according to the procedure.
10. Begin timing when all of the groups are ready. Have the groups record the beginning temperatures, then call out the time at two minute intervals for them to record the temperatures of both cans.
11. After 20 minutes, have the students calculate the difference between the beginning temperature and the ending temperature of each can and record it in the delta (ΔT) column of the chart on their investigation worksheet.
12. Display the *Insulation Results (5-1)* master and record the results of the groups.
13. Compare the groups' hypotheses with the results.
14. Discuss variables that might have made the results unreliable—differing amounts of insulation, the tops and bottoms of the cans were not insulated, different people reading the thermometers, etc. On the bottom of the master, list ways the experiment could be redesigned to make it more reliable with input from the students.
15. Instruct the students to graph their results.
16. Go to the *Home Activity* in the Student and Family Guide and review the assignment with the students.
17. Display pages 5 and 7-11 in the *Energy Saver* guide and review the information with students. Explain that they may use these pages to answer questions on the *Home Activity*.
18. Assign the activity and reading to the students and give them a completion date.
19. Remind students to take home their gaskets and Student and Family Guides, and to bring the guides back on the completion date.

▲Safety Note

Emphasize to students that they must have adult help to install gaskets.

✓ Procedure After Students Complete and Return the Activity

1. Review the activity with the students and answer any questions they have.
2. Discuss what the students learned from the activity.
3. Ask how many students installed the outlet and switchplate gaskets. Encourage those who did not install the gaskets to do so.
4. Have the students complete the *Lesson 5: Reflections* and *Lesson 5: Connections* activities in the Student and Family Guide.



Insulation Results

TEAM	UNINSULATED ΔT	INSULATED ΔT
1. Material: _____		
2. Material: _____		
3. Material: _____		
4. Material: _____		
5. Material: _____		



Lesson 6: Heating and Cooling

Overview

Heating and cooling systems in schools and homes use more energy than any other energy systems. This lesson will focus on learning to use these systems efficiently.

Objectives

- Students will be able to measure temperature accurately using appropriate tools and converting units when necessary.
- Students will be able to explain the importance of properly regulating temperature when considering efficiency and conservation.

Materials

- Digital thermometer
- Digital humidity/temperature pen

Masters

- *Thermostat Temperature Guide (6-1)*, page 36
- *Humidity/Temperature Pen (6-2)*, page 37

Student and Family Guide

- *Temperature Investigation*, page 45
- *Home Activity*, page 46
- *Reflections*, page 47
- *Connections*, page 48

Energy Saver Guide (see page 6 for more information)

- Pages 12-18

Home Energy Efficiency Kit Materials

- *Thermostat Temperature Guide*

Preparation

- Prior to the lesson, arrange to have someone from the maintenance or facilities staff show the students the HVAC (Heating, Ventilation, and Air Conditioning) system and answer questions about the energy sources that fuel the system(s).
- Schedule a time for students to visit their work areas.

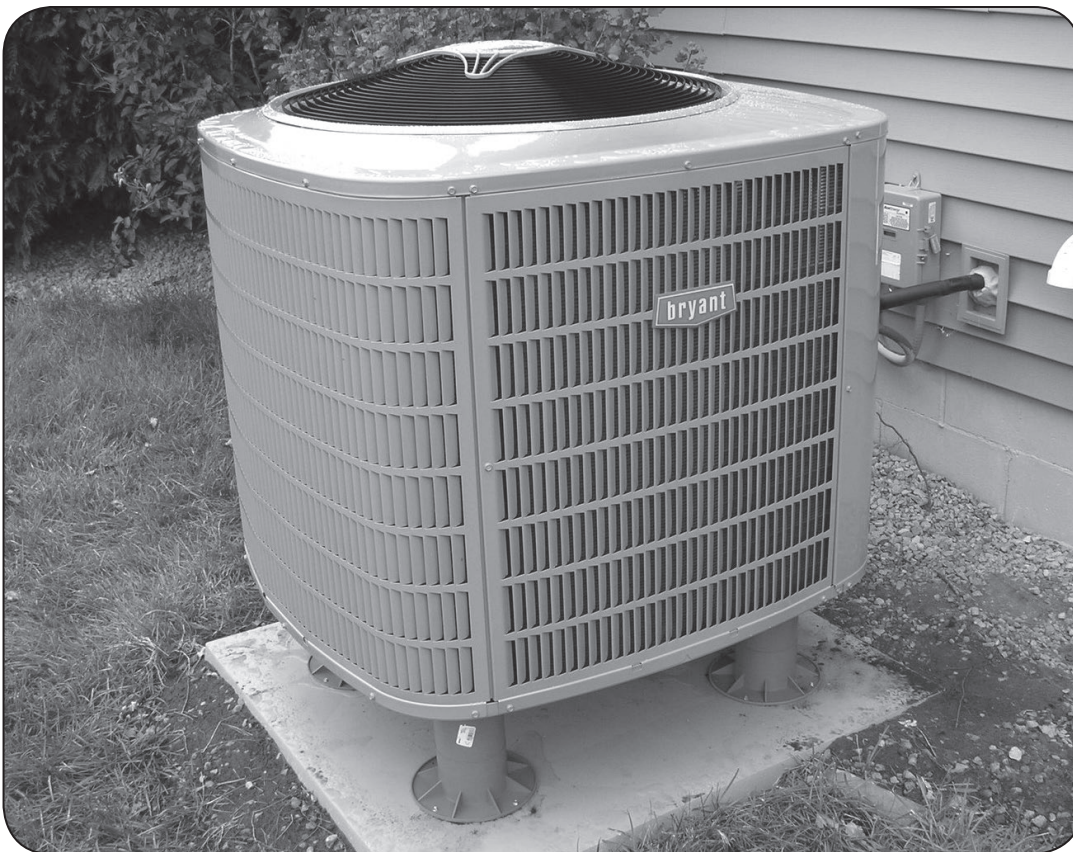
Procedure

1. Introduce the activity by discussing the importance of managing heating and cooling systems to save energy because these systems use more energy than any other systems in schools and homes.
2. Have the students inspect the school HVAC system with someone from the maintenance or facilities staff. Ask the staff member: Which system is in operation? What energy source fuels the heating system? What energy source fuels the cooling system?
3. Go to the *Temperature Investigation* in the Student and Family Guide. Direct students to the *Thermostat Temperature Guide* at the bottom of the page.
4. Display the *Thermostat Temperature Guide (6-1)* master and explain how to read it in both heating and cooling seasons.
5. Display the *Humidity/Temperature Pen (6-2)* master and explain how it works. Each group should take turns measuring temperature and humidity using the hygrometer.
6. Review the *Temperature Investigation* activity with the students and have them get into their groups. Provide each group with a student or lab thermometer for measuring temperature, if needed.
7. Instruct the students to complete the activity.
8. Review the results with the students using the master (6-1).
9. Discuss whether any action should be taken if temperatures are not within energy saving ranges.

10. Go to the *Home Activity* in the Student and Family Guide and review with the students.
11. Go to and display pages 12-18 of the *Energy Saver* guide and review the information with students. Explain that they may use these pages to answer questions on the *Home Activity*.
12. Assign the activity and give students a completion date.

✓ Procedure After Students Complete and Return the Activity

1. Review the activity upon completion and discuss with the students what they have learned.
2. Have the students complete the *Lesson 6: Reflections* and *Lesson 6: Connections* activities in the Student and Family Guide.





Temperature Guide

HEATING

ENERGY SAVING					ENERGY WASTING								
-20%	-10%	0%	+10%	+20%	+30%	+40%	+50%	+	+	+	+	+	+
64°	66°	68°	70°	72°	74°	76°	78°	80°	82°				
+	+	+	+	+	+	+	+	+	+	+	+	+	+

ENERGY WASTING

ENERGY SAVING

COOLING

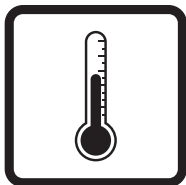
Classroom:

Office:

Gymnasium:

Cafeteria:

Library:



Humidity/Temperature Pen

HYGROMETER

Scientists measure the amount of water vapor in the air in terms of relative humidity—the amount of water vapor in the air relative to (compared to) the maximum amount it can hold at that temperature. Relative humidity changes as air temperature changes. The warmer the air is, the more water vapor it can hold.

Air acts like a sponge and absorbs water through the process of evaporation. Warm air is less dense and the molecules are further apart, allowing more moisture between them. Cooler air causes the air molecules to draw closer together, limiting the amount of water the air can hold.

It is important to control humidity in occupied spaces. Humidity levels that are too high can contribute to the growth and spread of unhealthy biological pollutants. This can lead to a variety of health effects, from common allergic reactions to asthma attacks and other health problems. Humidity levels that are too low can contribute to irritated mucous membranes, dry eyes, and sinus discomfort.

This digital humidity/temperature pen measures relative humidity and temperature and displays the readings on its face. It has a battery for power. It can display the temperature in Fahrenheit or Celsius. The reading shown on the right is 68.5°F. Devices that measure humidity are also called hygrometers.

The hygrometer displays relative humidity in terms of percentage. The hygrometer shown reads 35%. This means that the air contains 35 percent of the water vapor it can hold at the given air temperature. When the air contains a lot of water vapor, the weather is described as humid. If the air cannot carry any more water vapor, the humidity is 100 percent. At this point, the water vapor condenses into liquid water.

Maintaining relative humidity between 40 and 60 percent helps control mold. Maintaining relative humidity levels within recommended ranges is a way of ensuring that a building's occupants are both comfortable and healthy. High humidity is uncomfortable for many people. It is difficult for the body to cool down in high humidity because sweat cannot evaporate into the air.



Directions

ON/OFF KEY

Press the ON/OFF key to turn the power on or off.

°F/°C

Press the °F/°C key to select the temperature unit you want to use, Fahrenheit or Celsius.

MAX/MIN

Press the MAX/MIN key once to display the stored maximum readings for temperature and humidity.

An up arrow will appear on the left side of the display to indicate the unit is in the maximum recording mode.

Press the MAX/MIN key a second time to display the stored minimum readings for temperature and humidity. A down arrow will appear on the left side of the display to indicate the unit is in the minimum recording mode.

Press the MAX/MIN key a third time to return to normal operation.

CLEAR

If an up or down arrow is displayed, press the CLEAR key until - - - appears on the display. The memory is cleared. New maximum or minimum values will be recorded within 3 seconds.



Lesson 7: Water Heating

Overview

This lesson focuses on heating water and using hot water, the second largest energy cost in most homes.

Objectives

- Students will be able to measure temperature accurately using appropriate tools and converting units when necessary.
- Students will be able to list and describe methods for conserving water.
- Students will be able to explain a water heater's role in home energy savings.
- Students will be able to explain and calculate the payback period for appliances or major purchases.

Materials

- Digital thermometer
- Flow meter bag
- Hot water gauge

Masters

- Digital Thermometer (7-1)*, page 40
- EnergyGuide Label (7-2)*, page 41

Student and Family Guide

- Water Heating Investigation*, page 49
- Home Activity 1*, page 50
- Home Activity 2*, page 51
- Reflections*, page 52
- Connections*, page 53

Energy Saver Guide (see page 6 for more information)

- Pages 19-20

Home Energy Efficiency Kit Materials

- | | |
|-----------------------|------------------------|
| ▪Hot water gauge | ▪Bathroom sink aerator |
| ▪Flow meter bag | ▪Low flow showerhead |
| ▪Kitchen sink aerator | ▪Teflon tape |

Preparation

- Prior to the lesson, arrange to have someone from the maintenance or facilities staff show the students the water heating system(s) and answer questions about the energy sources that fuel the components. Schedule a time for students to visit their work areas, making sure there are adults present to assist the teams. If there is no hot water source in an assigned work area, consider substituting another work area for the students to use, such as a janitorial closet, restroom, etc.
- Review instructions for the hot water gauge and flow meter bag (in the Home Energy Efficiency Kit). Train the adult helpers in the operation of the equipment.

Safety Note

The flow meter bag should only be used to measure cold water. Make sure the adult helpers warn the students not to touch the hot water.



✓ Procedure

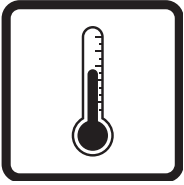
1. Introduce the lesson by discussing how we heat water at school and home.
2. Project and/or read the introduction on page 19 of the *Energy Saver* guide with the class.
3. List ways hot water is used in schools and homes.
4. List ways to cut water-heating bills—use less hot water, turn down the water heater thermostat, insulate the water heater, use an energy efficient water heater. Emphasize ways to use less hot water—taking short showers instead of baths, running the dishwasher only when it is full, washing clothes in cold water, filling the sink when hand-washing dishes instead of washing under running water, etc.
5. Display the *EnergyGuide Label (7-1)* master and explain the information it includes.
6. Inspect the school's water heating system with someone from the maintenance or facilities staff, locating the EnergyGuide label and the thermostat.
7. Ask the maintenance person the following questions: What is the energy efficiency rating from the EnergyGuide label? At what temperature is the thermostat set? What energy source is used to fuel the water heating system?
8. Instruct the students to enter the information in the appropriate blanks on the *Water Heating Investigation* in the Student and Family Guide.
9. Review the procedure for the rest of the investigation.
10. Instruct the students in the correct operation of the hot water gauge and flow meter bag.
11. Distribute one hot water gauge and one flow meter bag (from the Home Energy Efficiency Kit) to each team. Make sure an adult is available at each work area to assist each team with the investigation.
12. Instruct the students to complete the investigation with their adult assistants.
13. Review each team's data so that all students can record the data in their charts.
14. Compare recorded water temperatures with recommended temperatures.
15. Discuss whether any changes should be recommended based on the results of the discussion.
16. Review the *Home Activity 1* and *Home Activity 2* in the the Student and Family Guide with the students.
17. Display the two aerators, low flow showerhead, and the teflon tape from one of the Home Energy Efficiency Kits. Explain how to install them and how they reduce water flow.
18. Assign the activities and give students a completion date.
19. Display pages 19-20 in the *Energy Saver* guide and review the information with students. Explain that they may use these pages to answer questions on the *Home Activities*.
20. Remind students to take home their Student and Family Guides, hot water gauges, flow meter bags, aerators, showerheads, and teflon tape, and to bring back the guides on the completion date.

▲ Safety Note

Warn students to follow instructions about hot water safety, and to work with adults present when using hot water.

✓ Procedure After Students Complete and Return the Activities

1. Review *Home Activity 1* with the students and answer any questions they have.
2. Review *Home Activity 2* with the students using the answer key on page 42.
3. Discuss what the students learned from the activities.
4. Ask how many students installed the low flow showerhead and faucet aerators. Encourage those who did not install them to do so.
5. Have the students complete the *Lesson 7: Reflections* and *Lesson 7: Connections* activities in the Student and Family Guide.



Digital Thermometer

A digital thermometer measures the temperature of a substance and displays the temperature reading on its face. It has a battery for power. Sometimes they are waterproof for measuring the temperature of a liquid.

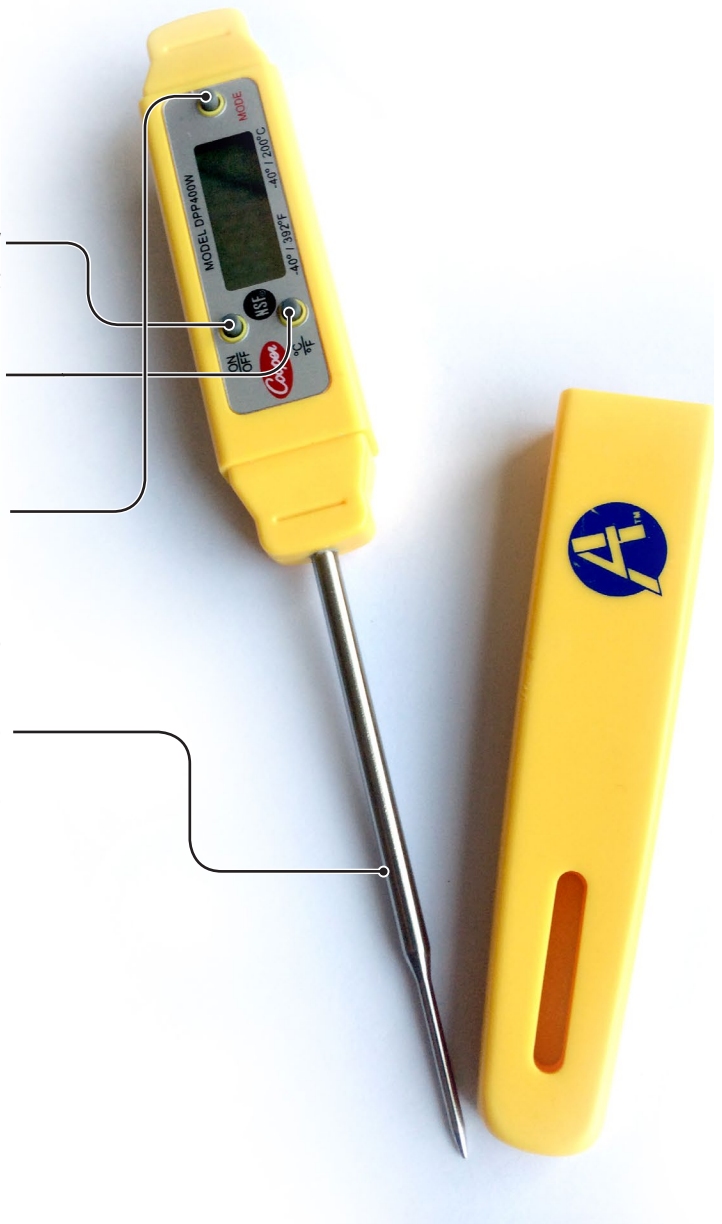
This digital thermometer can measure the temperature in Fahrenheit or Celsius. It shows the temperature range of the thermometer. It can read temperatures from -40° to 392°F and -40° to 200°C .

It has three buttons. The button on the bottom left is the **ON/OFF** switch. If the thermometer is not used for a few minutes, it turns itself off.

The **C/F** button on the bottom right switches from the Celsius scale to the Fahrenheit scale. The face of the thermometer will show a C or an F to indicate which scale is being used.

The **mode** button on the top holds the temperature reading when it is pushed. If you need the exact temperature of a liquid, you push the hold button while the thermometer is in the liquid, then remove the thermometer to read it. This button will also allow you to view the maximum and minimum temperatures measured when pushed two or three times.

The **metal stem** of the thermometer can measure the temperature of the air or the temperature of a liquid. The stem should be placed about halfway into a liquid to measure the temperature.



Federal law prohibits removal of this label before consumer purchase.

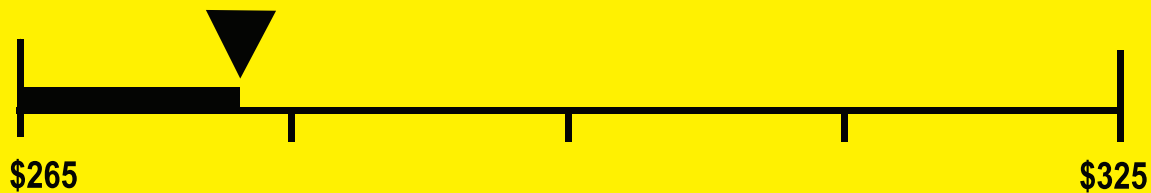
ENERGYGUIDE

Water Heater - Natural Gas
Capacity (first hour rating): 60 gallons

XYZ Corporation
Model XYZ

Estimated Yearly Energy Cost

\$273



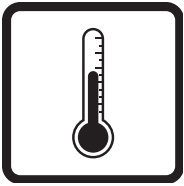
Cost Range of Similar Models

250 therms

Estimated Yearly Energy Use

Your cost will depend on your utility rates and use.

- ⊗ Cost range based only on models of similar capacity fueled by natural gas.
- ⊗ Estimated energy cost based on a national average natural gas cost of \$1.09 per therm.
- ⊗ For more information, visit www.ftc.gov/energy.



Home Activity 2 Answer Key

Comparing EnergyGuide Labels

Your family needs to buy a new water heater. Water heaters usually last a long time—10 years or more—so you can save a lot of money on an energy-efficient one. Use the chart below to figure out which water heater to buy, comparing the information on the EnergyGuide labels.

How many years will it take before you begin to save money? **Four years**

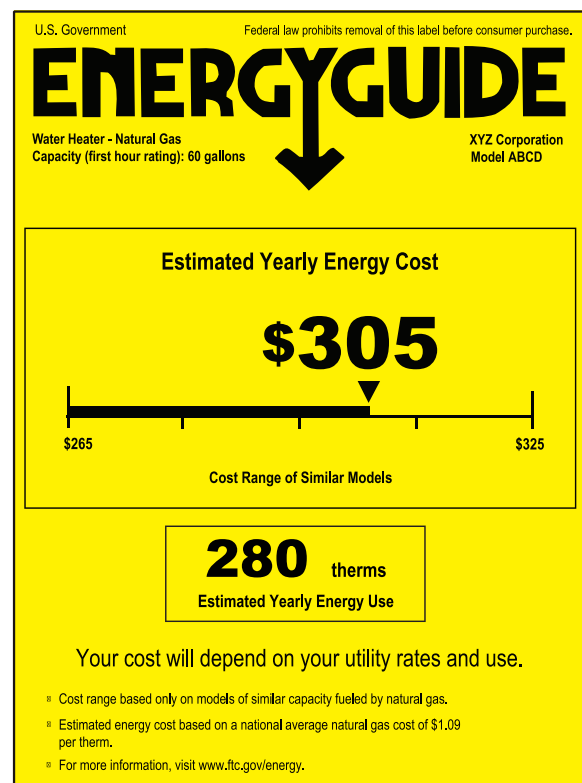
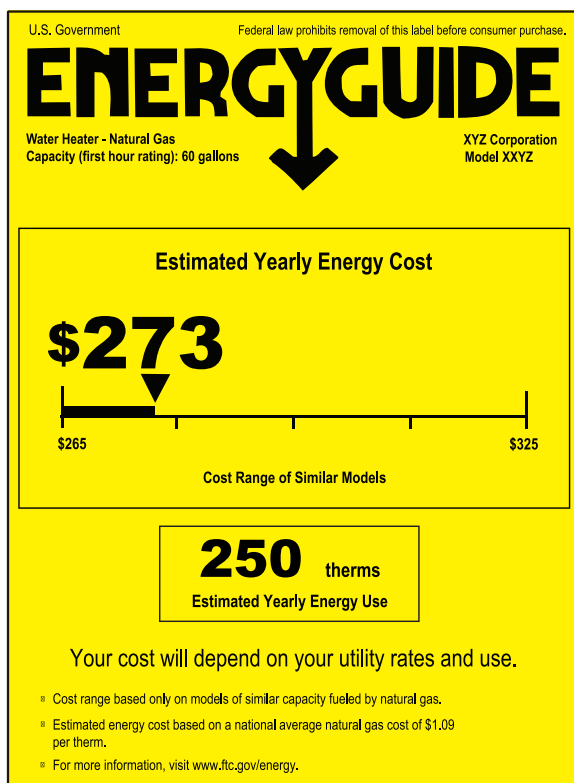
How much money will you have saved after seven years? **\$99.00**

Water Heater 1—Purchase Price: \$375.00

WATER HEATER 1	EXPENSES	COST TO DATE
Purchase Price	\$375	\$375
Year One	\$273	\$648
Year Two	\$273	\$921
Year Three	\$273	\$1,194
Year Four	\$273	\$1,467
Year Five	\$273	\$1,740
Year Six	\$273	\$2,013
Year Seven	\$273	\$2,286

Water Heater 2—Purchase Price: \$250.00

WATER HEATER 2	EXPENSES	COST TO DATE
Purchase Price	\$250	\$250
Year One	\$305	\$555
Year Two	\$305	\$860
Year Three	\$305	\$1,165
Year Four	\$305	\$1,470
Year Five	\$305	\$1,775
Year Six	\$305	\$2,080
Year Seven	\$305	\$2,385





Lesson 8: Windows

Overview

This lesson focuses on windows and how to reduce air infiltration.

Objectives

- Students will be able to explain how air leaks can be a hindrance to energy efficient homes.
- Students will be able to identify “leaky” windows.

Materials

- Pencils
- Tape
- Pieces of tissue paper (1” x 12”)

Student and Family Guide

- *Windows Investigation*, page 54
- *Home Activity*, page 55
- *Reflections*, page 56
- *Connections*, page 57

Energy Saver Guide (see page 6 for more information)

- Pages 21-22

Preparation

- Cut pieces of tissue paper into 30 1” x 12” strips.



Procedure

1. Introduce the lesson by discussing the advantages of windows in buildings and their energy implications, including how they can reduce the need for artificial light and how poorly constructed windows can allow cold air infiltration in winter and heat infiltration in summer.
2. Project and/or read to the class pages 21-22 in the *Energy Saver* guide.
3. Discuss the different types of windows and ways to prevent air infiltration through windows.
4. Go to the *Windows Investigation* worksheet in the Student and Family Guide.
5. Distribute pencils, tissue paper, and tape to the students.
6. Instruct the students to tape the tissue paper to the ends of the pencils as shown in the diagram on their worksheet.
7. Instruct the students to examine the classroom windows and record their observations.
8. Discuss the students’ observations and elicit opinions of the energy efficiency of the windows.
9. Instruct the students to go to their work areas, examine the windows, and record their observations.
10. Discuss the students’ observations.
11. Go to the *Home Activity* in the Student and Family Guide and review with the students.
12. Display pages 21-22 in the *Energy Saver* guide and review the information with students. Explain that they may use these pages to answer questions on the *Home Activity*.
13. Assign the activity and give students a completion date. Make sure each student takes home a pencil with tissue paper and his/her Student and Family Guide, and that they bring back the guides on the completion date.

Procedure After Students Complete and Return the Activity

1. Review the activity upon completion and discuss with the students what they have learned.
2. Have the students complete the *Lesson 8: Reflections* and *Lesson 8: Connections* activities in the Student and Family Guide.



Lesson 9: Lighting

Overview

This lesson focuses on energy efficient lighting.

Objectives

- Students will be able to compare and contrast the efficiency of different types of lighting.
- Students will be able to calculate life cycle costs and interpret savings based on calculations.
- Students will be able to define lumens and explain the importance of proper light levels.

Materials

- | | | |
|--|------------------------------|-----------------------------------|
| ▪ Incandescent light bulb | ▪ Light meter (with battery) | ▪ Light emitting diode bulb (LED) |
| ▪ Compact fluorescent light bulb (CFL) | ▪ Textbooks | |
| ▪ 3 Lamps | ▪ Flicker Checker | |

Masters

- *Light Bulb Comparison (9-1)*, page 47
- *Facts of Light (9-2)*, page 48
- *The Light Meter (9-3)*, page 49
- *Flicker Checker (9-4)*, page 50

Student and Family Guide

- | | | |
|--|---|--------------------------------|
| ▪ <i>Light Bulb Investigation</i> , page 58 | ▪ <i>Home Activity</i> , page 60 | ▪ <i>Reflections</i> , page 62 |
| ▪ <i>Flicker Checker Investigation</i> , page 59 | ▪ <i>Facts of Light Worksheet</i> , page 61 | ▪ <i>Connections</i> , page 63 |

Energy Saver Guide (see page 6 for more information)

- Pages 23-26

Home Energy Efficiency Kit Materials

- Light emitting diode bulb
- LED nightlight

Procedure

1. Introduce the topic of lighting by discussing its many uses and having students estimate the number of light bulbs in their homes.
2. Instruct the students to note the types of lighting in the classroom.
3. Ask how it is different from the lighting they have at home. Most lights in schools are fluorescent tubes. At home, incandescent and/or compact fluorescent bulbs are usually used, and maybe even some LED bulbs.
4. Explain that a compact fluorescent light bulb, or CFL, uses the same technology as a fluorescent tube.
5. Display the incandescent, CFL, and LED bulbs so the students can compare them visually.
6. Display the *Light Bulb Comparison (9-1)* master and explain that there are different types of bulbs available to consumers. Also highlight the cost of the bulbs and the following important light bulb vocabulary:
 - Lumens—a measure of the amount of light a bulb produces
 - Watts—a measure of the amount of electricity a bulb uses
 - Life—the average length of time a bulb is expected to operate in hours

7. Go to the *Home Activity* in the Student and Family Guide.
8. Instruct the students to use the information on the *Home Activity* to complete the *Facts of Light Worksheet*. They will determine purchase costs and energy costs of different types of bulbs. The electricity cost of \$0.125/kWh is the national average for residential consumers. To reinforce real life connections, use the residential electricity cost of your local utility.
9. Explain the life cycle cost as the cost over the operating life of the bulb, not daily or monthly cost.
10. Assign the activity and give students a completion date.
11. Display pages 23-26 in the *Energy Saver* guide and review the information with students. Explain that they may use these pages to answer questions on the *Home Activity*.
12. Remind students to take home their Student and Family Guides, LED bulb, and nightlight, and bring back the guides on the completion date.
13. Display *The Light Meter* (9-3) master and explain how to use the light meter.
14. Review the procedure for *Light Bulb Investigation* in the Student and Family Guide. Have students write their hypotheses in their Student and Family Guide.
15. Have students complete the activity and share results.
16. Display the *Flicker Checker* (9-4) master and explain how to use the Flicker Checker.
17. Review the procedure for the *Flicker Checker Investigation* in the Student and Family Guide.
18. Have students complete the activity and share results.

✓ Procedure After Students Complete and Return the Activity

1. Review the *Home Activity* with the students and answer any questions they have.
2. Display the *Facts of Light* (9-2) master. Have students provide the data to complete the information on the master and determine the life cycle savings for each type of bulb.
3. Discuss the results. Ask why so many people use incandescents when they could save money and energy by switching to CFLs or LEDs. Also discuss the amount of carbon dioxide that is released to power each type of bulbs for 25,000 hours.
4. Ask how many students installed the LED bulb and nightlight. Encourage those who did not install them to do so.
5. Have the students complete the *Lesson 9: Reflections* and *Lesson 9: Connections* activities in the Student and Family Guide.
6. Have students research the cost of various bulbs locally. If your local utility provider participates in lighting rebate programs, have your students research costs before and after rebates are applied.
7. Have the students compare the cost of electricity from your local utility with the national average.

Facts of Light Answer Key

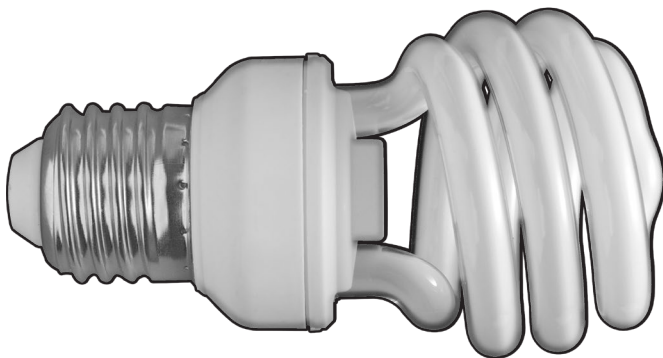
All bulbs provide about 850 lumens of light.



COST OF BULB	INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Life of bulb (how long it will light)	1,000 hours	3,000 hours	10,000 hours	25,000 hours
Number of bulbs to get 25,000 hours	25 bulbs	8.3 bulbs	2.5 bulbs	1 bulb
x Price per bulb	\$0.50	\$3.00	\$3.00	\$8.00
= Cost of bulbs for 25,000 hours of light	\$12.50	\$24.90	\$7.50	\$8.00
COST OF ELECTRICITY	INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Total Hours	25,000 hours	25,000 hours	25,000 hours	25,000 hours
x Wattage	60 watts = 0.060 kW	43 watts = 0.043 kW	13 watts = 0.013 kW	12 watts = 0.012 kW
= Total kWh consumption	1,500 kWh	1,075 kWh	325 kWh	300 kWh
x Price of electricity per kWh	\$0.125	\$0.125	\$0.125	\$0.125
= Cost of Electricity	\$187.50	\$134.38	\$40.63	\$37.50
LIFE CYCLE COST	INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Cost of bulbs	\$12.50	\$24.90	\$7.50	\$8.00
+ Cost of electricity	\$187.50	\$134.38	\$40.63	\$37.50
= Life cycle cost	\$200.00	\$159.28	\$48.13	\$45.50
ENVIRONMENTAL IMPACT	INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Total kWh consumption	1,500 kWh	1,075 kWh	325 kWh	300 kWh
x Pounds (lbs) of carbon dioxide per kWh	1.23 lb/kWh	1.23 lb/kWh	1.23 lb/kWh	1.23 lb/kWh
= Pounds of carbon dioxide produced	1,845.0 lbs carbon dioxide	1,322.3 lbs carbon dioxide	399.8 lbs carbon dioxide	369.0 lbs carbon dioxide



Light Bulb Comparison



INCANDESCENT BULB		HALOGEN		COMPACT FLUORESCENT (CFL)		LIGHT EMITTING DIODE (LED)	
Brightness	850 lumens	850 lumens	850 lumens	850 lumens	850 lumens		
Life of Bulb	1,000 hours	3,000 hours	10,000 hours	25,000 hours			
Energy Used	60 watts = 0.06 kW	43 watts = 0.043 kW	13 watts = 0.013 kW	12 watts = 0.012 kW			
Price per Bulb	\$0.50	\$3.00	\$3.00	\$8.00			



Facts of Light

All bulbs provide about 850 lumens of light.



COST OF BULB		INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Life of bulb (how long it will light)		1,000 hours	3,000 hours	10,000 hours	25,000 hours
Number of bulbs to get 25,000 hours					
x	Price per bulb	\$0.50	\$3.00	\$3.00	\$8.00
= Cost of bulbs for 25,000 hours of light					
COST OF ELECTRICITY		INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Total Hours		25,000 hours	25,000 hours	25,000 hours	25,000 hours
x	Wattage	60 watts = 0.060 kW	43 watts = 0.043 kW	13 watts = 0.013 kW	12 watts = 0.012 kW
= Total kWh consumption					
x	Price of electricity per kWh	\$0.125	\$0.125	\$0.125	\$0.125
= Cost of Electricity					
LIFE CYCLE COST		INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Cost of bulbs					
+	Cost of electricity				
= Life cycle cost					
ENVIRONMENTAL IMPACT		INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Total kWh consumption					
x	Pounds (lbs) of carbon dioxide per kWh	1.23 lb/kWh	1.23 lb/kWh	1.23 lb/kWh	1.23 lb/kWh
= Pounds of carbon dioxide produced					



The Light Meter



Operating Instructions

1. Insert the battery into the battery compartment in the back of the meter.
2. Slide the ON/OFF Switch to the ON position.
3. Slide the Range Switch to the B position.
4. On the back of the meter, pull out the meter's tilt stand and place the meter on a flat surface in the area you plan to measure.
5. Hold the Light Sensor so that the white lens faces the light source to be measured or place the Light Sensor on a flat surface facing the direction of the light source.
6. Read the measurement on the LCD Display.
7. If the reading is less than 200 fc, slide the Range Switch to the A position and measure again.

Light Output or Luminous Flux

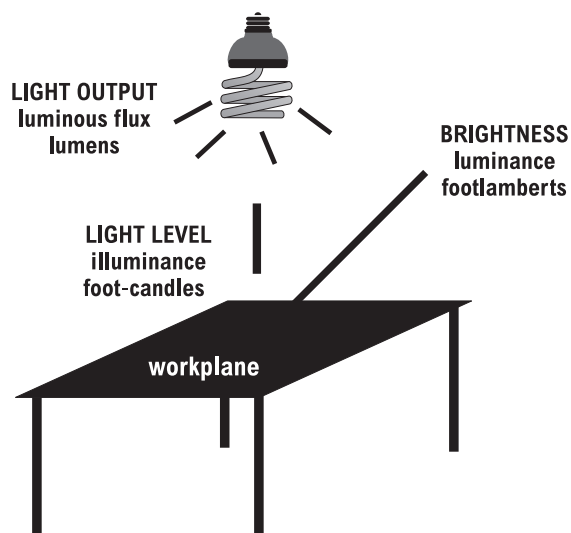
A lumen (lm) is a measure of the light output (or luminous flux) of a light source (bulb or tube). Light sources are labeled with output ratings in lumens. A T12 40-watt fluorescent tube light, for example, may have a rating of 3050 lumens.

Light Level or Illuminance

A foot-candle (fc) is a measure of the quantity of light (illuminance) that actually reaches the workplane on which the light meter is placed. Foot-candles are workplane lumens per square foot. The light meter can measure the quantity of light from 0 to 1000 fc.

Brightness or Luminance

Another measure of light is its brightness or luminance. Brightness is a measure of the light that is reflected from a surface in a particular direction. Brightness is measured in footlamberts (fL).





Flicker Checker

Overview

Most commercial buildings use fluorescent tube lighting. This activity teaches students to determine if a building is using the most energy efficient lighting. The Flicker Checker differentiates between fluorescent lights with magnetic and electronic ballasts.

Background

The most important difference between incandescent and fluorescent light bulbs is the process by which they produce light. Incandescent bulbs produce light by passing current through a wire. The wire, often made of tungsten, is a resistor. A resistor is a device that turns electrical energy into heat and light energy.

The wire inside an incandescent light bulb is a special type of resistor called a filament. Many incandescent bulbs have clear glass so you can see the filament. In addition to the wire, the bulb contains a gas called argon. The argon gas helps the bulb last longer. If the wire were exposed to air, it would oxidize and the wire would burn out faster. The argon does not react with the metal like air does. The argon also helps the filament become a better resistor—it actually helps it produce more light than air would. Resistors emit more heat than light. In an incandescent light bulb, 90 percent of the energy from the electricity is turned into heat and only 10 percent of the energy is turned into light.

A fluorescent bulb produces light differently. It produces light by passing an electric current through a gas. The electrons in the molecules of gas become excited because of the electrical energy and some escape from the gas molecules. They bounce around and crash into the walls of the tube. The walls of the tubes are painted with a material that gives off light (it fluoresces) when electrons hit it. If you have ever seen the inside of a fluorescent tube, the glass is coated with white powdery material. This powder is what fluoresces (gives off light).

The part of a fluorescent light bulb that sends the current through the gas is called a ballast. There is a part of the ballast at each end of the tube. The ballast is an electromagnet that can produce a large voltage between the two parts. It is this voltage that gives the electrons of the gas molecules the energy inside the tube.

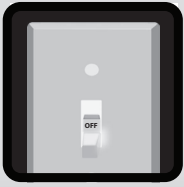
A magnetic ballast has an iron ring wrapped with hundreds of turns of wire. The current from the electrical outlet runs through the wire in the ballast. The wire also is a resistor to some degree, so there is some heat produced. There is also a little heat given off by the gas. A fluorescent bulb with a magnetic ballast converts about 40 percent of the electricity into light and 60 percent into heat.

An electronic ballast has a microchip, like that found in a computer, instead of the coils of wire. This ballast is about 30 percent more efficient in turning electrical energy into light than a magnetic ballast. Some heat is produced in the gas, but not in the ballast itself.

The reason that the Flicker Checker can tell the difference between the magnetic and electronic ballasts is because of the way the current is delivered to the gas. In any outlet in the United States that is powered by an electric company, the electricity is sent as alternating current—it turns on and off 60 times each second. Because the light with the magnetic ballast has wires attached to the outlet, it also turns on and off 60 times per second. The microchip in the electronic ballast can change that frequency. Light bulbs with electronic ballasts are made to turn on and off between 10,000 and 20,000 times each second.

FLICKER CHECKER SHOWING A MAGNETIC BALLAST





Lesson 10: Appliances and Machines

Overview

This lesson examines the energy consumption of machines, appliances, and other electrical devices.

Objectives

- Students will be able to quantify their energy consumption by measuring the load of common devices.
- Students will be able to calculate or estimate an energy bill using appropriate rates, and converting units as needed.
- Students will be able to explain how the use of electronic devices and appliances contributes to greenhouse gas emissions.
- Students will be able to explain and calculate the payback period for appliances or major purchases.

Materials

- Kill A Watt™ monitor
- Pluggable appliances

Masters

- *Kill A Watt™ Monitor (10-1 and 10-2)*, pages 53-54
- *Measuring Electricity Use Chart (10-3)*, page 55
- *EnergyGuide Label (10-4)*, page 56

Preparation

- Review the operating instructions of the Kill A Watt™ monitor on page 53.
- Gather pluggable devices students might see or use in school or at home.

Home Energy Efficiency Kit Materials

- Refrigerator thermometer

Procedure

1. Introduce the topic by discussing all of the machines in the classroom that use electricity.
2. Display the *Kill A Watt™ Monitor (10-1 and 10-2)* masters, explaining what it does and how it is operated.
3. Review the *Measuring Electricity Use* and *The Environment and You* activities in the Student and Family Guide with the students. Have the students decide as a class which machines in the classroom they would like to investigate with the Kill A Watt™ monitor.
4. Assign students in groups of two to measure machines they would use in the classroom, following the procedure on the *Measuring Electricity Use* activity. Instruct the student groups to interview someone in each work area to determine the number of hours the machine is in use each week.
5. Display the *Measuring Electricity Use Chart (10-3)* master and review the example. Enter the machines the students investigated and work through the math with students. Have students share their data and complete data calculations independently or with group input.
6. Have students complete *The Environment and You* as a class to determine how much carbon dioxide each item would use. Discuss and go over the calculations as a class.
7. Assign students to groups and have them then measure items they would use at home, using the Kill A Watt™ monitor. Instruct students that they will interview family members to determine the number of hours they might use that device at home each week. They should record their wattage and hourly estimates on the *Home Activity 1*, which they will finish at home.
8. Go to and display page 27 of the *Energy Saver* guide. Have students read the introduction to appliances. Explain that they may use pages 27-34 to answer questions on the *Home Activities*.
9. Display the *EnergyGuide Label (10-4)* master and review the information included. Note any similarities and differences students remember from the water heater label in lesson 7.

Student and Family Guide

- *Measuring Electricity Use* and *The Environment and You*, pages 64-65
- *Home Activities 1-3*, pages 66-70
- *Reflections*, page 71
- *Connections*, page 72

Energy Saver Guide (see page 6 for more information)

- Pages 27-34

10. Review the *Home Activities 1, 2, and 3* in the Student and Family Guide.
11. Assign the activities and give students a completion date to finish the activities.
12. Remind students to take home their Student and Family Guides and refrigerator thermometers, and bring back their guides on the completion date.

✓ **Procedure After Students Complete and Return the Activities**

1. Review the *Home Activities* with the students and answer any questions they have.
2. Discuss what the students learned from the activities.
3. Have the students complete the *Lesson 10: Reflections* and *Lesson 10: Connections* activities in the Student and Family Guide.



Kill A Watt® Monitor

The Kill A Watt® monitor allows users to measure and monitor the power consumption of any standard electrical device. You can obtain instantaneous readings of voltage (volts), current (amps), line frequency (Hz), and electric power being used (watts). You can also obtain the actual amount of power consumed in kilowatt-hours (kWh) by any electrical device over a period of time from one minute to 9,999 hours. A kilowatt is 1,000 watts.

Operating Instructions

1. Plug the Kill A Watt® monitor into any standard grounded outlet or extension cord.
2. Plug the electrical device or appliance to be tested into the AC Power Outlet Receptacle of the Kill A Watt® monitor.
3. The **LCD** displays all meter readings. The unit will begin to accumulate data and powered duration time as soon as the power is applied.
4. Press the **Volt** button to display the voltage (volts) reading.
5. Press the **Amp** button to display the current (amps) reading.
6. The **Watt** and **VA** button is a toggle function key. Press the button once to display the Watt reading; press the button again to display the VA (volts x amps) reading. The Watt reading, not the VA reading, is the value used to calculate kWh consumption.
7. The **Hz** and **PF** button is a toggle function key. Press the button once to display the Frequency (Hz) reading; press the button again to display the power factor (PF) reading.
8. The **KWH** and **Hour** button is a toggle function key. Press the button once to display the cumulative energy consumption. Press the button again to display the cumulative time elapsed since power was applied.

What is Power Factor?

The formula **Volts x Amps = Watts** is used to find the energy consumption of an electrical device. Many AC devices, however, such as motors and magnetic ballasts, do not use all of the power provided to them. The power factor (PF) has a value equal to or less than one, and is used to account for this phenomenon. To determine the actual power consumed by an AC device, the following formula is used:

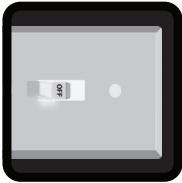
$$\text{Volts} \times \text{Amps} \times \text{PF} = \text{Watts Consumed}$$





Kill A Watt® Monitor





Measuring Electricity Use Chart

MACHINE OR APPLIANCE	HOURS PER WEEK	HOURS PER YEAR	WATTS (W)	KILOWATTS (kW)	RATE (\$/kWh)	ANNUAL COST
Copier	10	400	1,265 W	1.265 kW	\$0.10	\$50.60

U.S. Government

Federal law prohibits removal of this label before consumer purchase.

ENERGYGUIDE



Refrigerator-Freezer

- Automatic Defrost
- Top-mounted
- No Through-the Door Ice Service

BRAND B

Model 1

Capacity: 21.1 Cubic Feet

Compare ONLY to other labels with yellow numbers.
Labels with yellow numbers are based on the same test procedures.

Estimated Yearly Energy Cost

\$49

\$40

\$65

Cost range not available

410 kWh

Estimated Yearly Electricity Use

- ☒ Your cost will depend on your utility rates and use.
- ☒ Cost range based only on models of similar capacity with Automatic Defrost, Top-mounted, and No Through-the Door Ice Service.
- ☒ Estimated energy cost based on a national average electricity cost of 12 cents per kWh.



ftc.gov/energy



Lesson 11: What We Have Learned

Overview

Students review what they have learned and what changes they have made to use less energy at school and at home.

Objectives

- Students will be able to differentiate between energy efficiency and energy conservation, citing examples of each concept.
- Students will be able to create a plan or suggestions for ways to tackle energy efficiency and energy conservation in the home.

Student and Family Guide

- Your Family Rating*, page 73
- Connections*, page 74
- Post-Assessment*, page 78

✓ Procedure

1. Discuss what the students learned from the unit and what they think their families learned.
2. Discuss the successful installation and use of the Home Energy Efficiency Kit materials as well as barriers to installation and use.
3. Have the students complete the *Lesson 11: Connections* activity in the Student and Family Guide.
4. Have the students participate in a culminating activity to reinforce the knowledge they have acquired and teach others. Suggestions include NEED's *Energy House* or *Energy Conservation Contract* activities; designing and developing an energy expo to exhibit at a PTA meeting or the public library; designing and developing lessons to teach younger students; and writing and performing a play for the school.
5. Remind students to take home their Student and Family Guides.

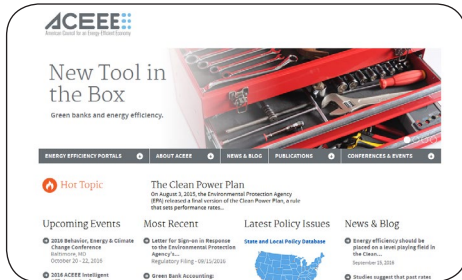
✓ Procedure After Completion of Unit

1. Go to the *Post-Assessment* in the Student and Family Guide. Have the students complete the page.
2. Instruct students to remove the *Post-Assessment*. Collect these to send to NEED for evaluation.
3. Complete the *Evaluation Form* on page 59.
4. Send student *Pre-* and *Post-Assessments*, and the *Evaluation Form* to NEED:

The NEED Project
8408 Kao Circle
Manassas, VA 20110



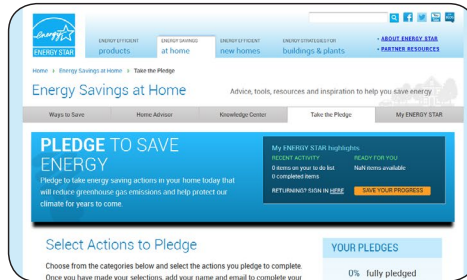
Internet Resources



American Council for an Energy-Efficient Economy

Promoting economic prosperity, energy security, and environmental protection through energy efficiency.

www.aceee.org



Energy Savings at Home

Take the ENERGY STAR® Pledge and do your part to save energy and reduce emissions.

www.energystar.gov/campaign/takeThePledge



Green Button Data Initiative

Utility customers are able to access energy usage information on a daily and hourly basis through an app. Learn how to get started with your participating provider.

www.energy.gov/data/green-button



Energy Efficiency and Renewable Energy (EERE)

EERE invests in clean energy technologies that strengthen the economy, protect the environment, and reduce dependence on foreign oil.

www.energy.gov/eere/office-energy-efficiency-renewable-energy



Energy Hog

This interactive video game is full of sound effects, cartoon characters, and activities that teach students about energy efficiency.

www.energység.org



Energy Kid's Page

Energy Ant hosts this site containing energy facts, fun and games, classroom activities, and more.

www.eia.gov/kids



Find Your Efficiency Zone

Based on the zip code entered, it will provide a comparison of the energy costs of an average home and an energy-efficient home in your area.

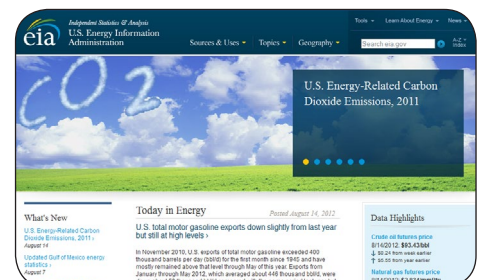
<http://homeenergysaver.lbl.gov/consumer>



Ask A Scientist

This online question-and-answer service for K-12 teachers and students was launched in 1991. Today Ask A Scientist is in several formats including YouTube™, AMA, and on Twitter.

www.anl.gov/education/learning-center/classroom-resources



U.S. Energy Information Administration

The Energy Information Administration of the U.S. Department of Energy has up-to-date and historical information on energy consumption in many formats.

www.eia.gov

Saving Energy at Home and School Teacher Guide



Saving Energy at Home and School Evaluation Form

State: _____ Grade Level: _____ Number of Students: _____

- | | | |
|--|------------------------------|-----------------------------|
| 1. Did you conduct the entire unit? | ☐ Yes | ☐ No |
| 2. Were the instructions clear and easy to follow? | ☐ Yes | ☐ No |
| 3. Did the activities meet your academic objectives? | ☐ Yes | ☐ No |
| 4. Were the activities age appropriate? | ☐ Yes | ☐ No |
| 5. Were the allotted times sufficient to conduct the activities? | ☐ Yes | ☐ No |
| 6. Were the activities easy to use? | ☐ Yes | ☐ No |
| 7. Was the preparation required acceptable for the activities? | ☐ Yes | ☐ No |
| 8. Were the students interested and motivated? | ☐ Yes | ☐ No |
| 9. Was the energy knowledge content age appropriate? | ☐ Yes | ☐ No |
| 10. Would you teach this unit again? | ☐ Yes | ☐ No |

Please explain any 'no' statement below

How would you rate the unit overall? ☐ excellent ☐ good ☐ fair ☐ poor

How would your students rate the unit overall? ☐ excellent ☐ good ☐ fair ☐ poor

What would make the unit more useful to you?

Other Comments:

Please fax or mail to **The NEED Project**
8408 Kao Circle
Manassas, VA 20110
FAX: 1-800-847-1820



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Energy Future Holdings	Nicor Gas	TXU Energy
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Escambia County Public School Foundation	Noble Energy	University of North Carolina
Eversource	Nolin Rural Electric Cooperative	University of Tennessee
Exelon Foundation	Northern Rivers Family Services	U.S. Department of Energy
First Roswell Company	North Carolina Department of Environmental Quality	U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy
Foundation for Environmental Education	North Shore Gas	U.S. Department of Energy–Wind for Schools
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