Energy Efficiency at Home -- An Interdisciplinary Module for Energy Education

Grades: 5-8

Topic: Energy Basics, Energy Efficiency and Conservation

Owner: University of Northern Iowa -- Department of Earth Science

This educational material is brought to you by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

OVERVIEW OF MODULE 1

You Make It Happen ... Energy Efficiency at Home

During the past years, an abundance of inexpensive fuels has been available. This has led many of us to develop "bad habits" in terms of our energy use. As supplies become more limited, and more costly both to our pocketbook and in terms of damage to the environment, we are suddenly facing an energy dilemma. It is important that we become more wise and efficient in our energy use. This requires a personal commitment by students and a belief that they can, in fact, influence others to engage in more energy efficient behaviors.

Through combined and simultaneous efforts in science, mathematics, language arts, and social studies, students will learn about the importance of home energy management. They will also conduct an energy inventory of their home, review simple ways to increase energy efficiency in their home, and learn how to effectively communicate ideas about energy efficiency to others.

The focal point of the science portion of this module revolves around four investigations which students conduct in the science classroom. Each activity is designed to familiarize students with one of four important aspects of electrical energy use in the home. These areas include: air infiltration, lighting, appliances, and general energy waste resulting, for the most part, from the individual behaviors of the occupants. Students will become familiar with ways to increase home energy efficiency in each of the four topic areas. As a culminating experience students will be responsible for preparing, delivering, and explaining a final report to parents regarding energy use and efficiency in their home.

In the mathematics portion of the "You Make It Happen" module students will study how energy use varies over time. Monthly utility bills covering a one year period will provide data for student analysis. Students will construct and interpret graphs of monthly energy usage. They will then practice making inferences and developing convincing arguments, based on their data, as to the causes of monthly fluctuations in energy use.

The language arts portion of the "You Make It Happen" module involves students in the development of a video aimed at promoting energy efficiency. The steps involved in this process are designed to enhance student nonverbal and verbal communication skills, especially in the area of persuasion. Students will decide, as a class, on the format of their video. They will then write, direct, and produce the video. This student production will be used as a means of helping convince each student's family of the ease with which many energy efficient measures can be adopted.

In social studies students will study the history of home design in Iowa from the 1840s to modern times. This look into structural design will take on an energy perspective in that students will constantly be asked to look at and to create designs that capitalize on energy efficiency, given the available resources of the time period being studied. As a culminating experience, students will be asked to design an energy efficient dwelling of the future.

The amount of time required to complete tasks, discussions, and investigations will vary greatly with each school and within each discipline. It is suggested that the module begin at the same time in each of the four disciplines. The fact that students will be discussing a common theme in different classes adds strength to the program. However, do not expect the materials to be covered at the same speed in each

class. It is perfectly acceptable if, for example, the social studies portion of the module takes 5 class periods while science and language arts take between 8 and 10 class periods.

Table of Contents Next Section

SCIENCE ACTIVITES

Home Energy Inventory

Objectives

1. Students will be able to identify and explain to others, those areas in the home in which lighting is being used efficiently and those areas in which lighting efficiency can be increased.

2. Students will be able to explain why air leakage is a source of energy waste in homes. They will also be able to identify and explain to others those areas in the home in which air leakage is a problem.

3. Students will be able to order most common appliances in terms of the amount of electricity each consumes and can identify and explain to others, those areas in the home in which appliances can be used more efficiently.

4. Students will be able to identify and explain to others, those areas in the home in which energy is being used inefficiently and suggest changes that will lead to more efficient energy use.

Module Overview - Science

The focal point of the science portion of this unit revolves around four investigations which students will conduct in the science classroom. Each activity is designed to familiarize students with one of four important aspects of electrical energy use in the home. These areas include: air infiltration, lighting, appliances, and general energy waste resulting, for the most part, from the individual behaviors of the occupants. As students progress through each activity they will be assigned to collect data from their homes. Students will become familiar with ways to increase home energy efficiency in each of the four topic areas. As a culminating experience each student will be responsible for collecting data in their home on one or more of the areas mentioned above. Each student will then prepare, deliver, and explain a final report to their parents regarding energy use and efficiency in their home.

Begin the unit with the video "Kids Can Make It Happen!" Show the video for the first time without introductory comments. After initial viewing of the tape, ask students to take an empty piece of paper and fold it in halves so their paper is divided into four squares. Instruct students to write the headlines indicated to the right, one in each square.

Show the video tape a second time. This time, ask students to list, on their paper, those things that were checked for energy efficiency in the film. Each item should be listed under the appropriate category. For example, students should note to check windows, electrical outlets, and the fireplace for air infiltration.

Ask students to brainstorm in small groups about other items that can be added to each category on their table. Following this session, develop a class list of items to be checked in conducting a home energy inventory. If possible, make the class list into a bulletin board so students can be exposed to these suggestions for the remainder of the unit.

At this point, give students an overview of the unit. Students will be conducting 4 different experiments in science class. Each one is designed to provide information on one of the four areas listed in the video tape. Activity 5 will require students to collect data on energy use in their home. Not only will students be reporting their findings to the teacher, they will also be writing letters and summary reports for their parents. Explain to students that the aim is to convince their parents to make changes leading to more efficient home energy use. You may wish to begin the unit by quickly reviewing what will be required of students in Activity 5. Some students may choose to begin collecting home energy use data as they progress through the first four activities rather than waiting until the end.

Ask students if they feel they can successfully convince their parents to use energy more efficiently. What approaches do students think would be most successful in changing their parent's behaviors? Students may suggest some of the following approaches:

- explain how easy and inexpensive it is to make many changes that result in more energy efficient use.
- show parents that you do not have to suffer or be uncomfortable when you increase your energy efficiency.
- show parents that you can save money by increasing energy efficiency.
- explain to parents that overuse of energy can have adverse effects on the environment.

The presentation of the four suggested science activities is flexible and should be adapted to your classroom situation. Limited amounts of equipment and/or space may necessitate your altering the approach suggested below. Several other possible arrangements are presented in the "Alternative Approaches" section of the teacher notes for each individual activity.

It is likely that a limited number of electrical meters will be available for use in your classroom. Most classrooms should be able to secure at least three of these. With a class size of from 24-32 students, it is suggested that the teacher divide the class into groups of 2-3 students. Assign each of these groups to begin with one of the science activities (Lumen Essence, Watch Your Watts, Slipping Through the Cracks, or Be a Waste Watcher). Once a group of students has completed their first activity, get them started on another of the four activities. Each of these activities has a Summing Up component in which students are asked to summarize and, in some cases, apply their findings to new situations. Make certain that students complete these portions of each activity before allowing them to proceed to another activity. Continue until all students have rotated through each of the four activities.

With the above suggested approach, your classroom will be a busy place. You may encounter problems with some groups wishing to dim the lights while others are in need of good lighting. Be aware that these situations may arise and make plans to deal with them.

Set up stations around the room for each activity. Pay attention to the needs of each group. For example, the "Watch Your Watts" groups must be near electrical outlets, as must the student groups working on "Lumen Essence".

Introduce students to the activities by giving a brief overview of each activity. It is important to familiarize students with the proper use of the electrical meter and the light meter. Specific pointers are provided in the teacher notes for each of the four activities. Before students break into working groups, spend time reviewing safety as well (see teacher notes for each activity.) Do not assume that students will read the warnings provided with each activity....a verbal warning, followed by written reminders is the best approach!

Keep close tabs on the progress of student's written work. Many times, students will get so involved and

excited with using the materials and equipment that they will not follow through by completing the written portion of each activity. While students are designing experiments and collecting data in groups, it is recommended that each student complete their own student data sheets. Each activity is closely tied with data students will gather in their homes during Activity 5. The personal nature of the data demands personal, rather than group responses to the proposed questions.

Alternative Approach

In the ideal situation, each student would have hands-on experience with each activity. If, however, time does not permit all of the groups to complete all of the activities, you may want to assign each group to conduct only one or two of the investigations. Even with the ideal situation, it is unlikely that all groups will complete the activities at the same time. Encourage the "faster" groups to complete each of the four activities, but allow "slower" groups to complete only one or two. If this approach is taken, make arrangements for a group to report back to the class on each activity. In this way, those students who did not complete the activity, will have some exposure to the material presented.

Suggested Evaluation Techniques

Activity 5, Taking the Message Home, serves as a culminating project for the home energy inventory. You may want to require students to prepare and deliver a brief oral report to their parents/guardian as part of this activity. Parents/guardians can then be asked to critique the student presentation and supporting written material.

Ideally students will need class time to adequately plan and prepare their presentation to an adult in their home. To introduce students to this process, the teacher could model a sample presentation, while students play the role of parent/guardian and critique the presentation. The teacher should follow the same guidelines provided to parents/guardian for structuring the presentation. Provide students with a copy of the same evaluation form parents/guardian will be using.

Following the mock presentation, students will plan their presentation to parents. They may include suggestions for improvement and should also include comments on those energy efficient practices they observed in the target home.

An instruction sheet, in the form of a letter, can be sent home with students to parents/ guardians, along with the evaluation form. (See Appendix A) Following the presentation, parents can be requested to complete an evaluation sheet (Appendix A), place it in an envelope, write their signature across the seal, and send it back to the teacher. Parents/ guardians may share the evaluation results with their child, but are not required to do so. If you would rather students forego the home presentations, simply revise the letter to ask for parent/ guardian comments on the written reports they receive from their child.

Lumen Essence

Teacher Notes

Objective:
Describe some of the differences between incandescent and fluorescent light bulbs.

Materials:

lamps
hot mitts
fluorescent light bulbs (save the boxes)
incandescent light bulbs (save the boxes)
electric meters (See Appendix A for hints on obtaining meters and for assembly instructions).

Safety Warnings:
If students will be using only one lamp, they will likely need to change the light bulbs as they progress through their experiment. Caution students that the bulbs may be very hot. You may want to have some kitchen hot mitts available for handling bulbs. Also, all lamps should be unplugged when changing bulbs! Be sure to announce these precautions to the class as a whole.

Suggested Teaching Strategies:
Review with students the two research questions posed on the student page as a way on introducing this activity. Ask students to make predictions about the relationship between watt readings and the amount of electricity used by light bulbs. Be sure to ask students to give reasons for their predictions. Most students will likely have noticed that a 60 watt bulb is brighter than a 25 watt bulb. They should be able to logically extend this idea to conclude that the brighter bulb must use more electricity. The neat thing is that by using an electrical meter, students can see just how much more electricity is used by larger watt bulbs.

Using the electrical meter:
1. Plug a lamp into the outlet attached to the meter.
2. Now plug the meter into an electrical outlet. Turn on the lamp and direct students to observe the moving disk. Notice the thick black line on the dial. This is the zero mark. Before beginning to record data, let the meter "run" until the black mark is pointing straight out.
3. With the light turned on, count the number of times the black line on the moving disk rotates in one minute. If less than one rotation is made, record the number appearing on the dial. This will indicate what fraction of 100 the dial has spun.
4. Test other bulbs in the same way. Make certain that the zero mark on the disk is set at the same place before you begin each reading. (You can use a hair dryer to set the zero mark quickly.)

Sample Data Collection Sheets:
For students with special needs, or for situations in which students are having difficulty organizing their data, you may find it necessary to provide certain students with a prepared data collection sheet. Avoid doing this for all groups, as designing data tables is an important skill for students to learn. Most students need additional opportunities to practice designing data tables.

Background
Important terms in studying lighting are wattage, lumens, illumination, incandescent and fluorescent. Please resist the temptation to give definitions to students. It is more important for students to have a feel for what each term means, rather than memorizing a definition.

How does a light bulb work? The incandescent light bulb consists of a resistive tungsten filament, attached to a metal screw-type base. The filament is mounted inside a glass bulb, which is filled with a gas (usually argon or nitrogen). The gas prevents the rapid burning of the filament. The resistance causes the filament to be heated to incandescence, producing light. Imagine rubbing your hands quickly back and forth on a rope. They get hot. Well the rubbing of electricity on the wire in a light bulb gets so hot, the wire glows with light.

Fluorescent light bulbs contain filament-like electrodes at each end of the tube. The walls of the tube are

coated with phosphor (a material that fluoresces (glows) under ultraviolet (UV) light) and is filled with mercury vapors. Electricity flows through the filament, causing it to emit electrons. The electrons cause the mercury vapor to break down and discharge UV radiation. This causes the phosphor to glow, producing light.

A 7 watt compact fluorescent bulb produces the same light output as a 40 watt incandescent bulb, yet it lasts 10 times longer. A 7 watt compact fluorescent bulb uses 70% less energy than does a standard 40 watt incandescent bulb. Fluorescent bulbs have many environmental advantages over incandescent bulbs . In its 10,000 hour lifetime, 277 pounds of coal can be saved if the electricity in your area is generated by coal-fired power plants, by replacing one 40 watt incandescent bulb with a 7 watt fluorescent bulb. This will reduce the emission of carbon dioxide greenhouse gases and of sulfur dioxide (a main contributor to acid rain). If electricity in your area is being generated by oil, you can save one barrel of oil by making this bulb replacement. This is enough oil to drive an economy car clear across the United States. Since one compact fluorescent bulb will last as long as up to 10 incandescent bulbs, this will also reduce solid waste in landfills. (The information contained in this paragraph was derived from the packaging box of a fluorescent bulb. Be sure to save all light bulb containers. Students can use them as a good source of additional information.)

Lumens measure the amount of light produced by a bulb. The term "illumination" is derived from the word "lumen". Illumination refers to the act of supplying or brightening with light. Watts is a measure of the actual amount of electricity the bulb, or any electrical device, uses. The larger the wattage on a bulb or electrical appliance, the more electricity it takes to operate that device.

Sample Data:
Research Question 1: The sample data shown below provides sufficient evidence to answer research question #1.

Wattage, Bulb Type & Meter Rotations in 2 Minutes

- 60 Watt incandescent: 0.75
- 25 Watt incandescent: 0.38
- 15 Watt incandescent: 0.25
- 15 Watt fluorescent: 0.15
- 7 Watt fluorescent: 0.10

NOTE: The actual meter rotations will vary depending on the kilowatt rating of the meter.

Conclusion: The higher the wattage of a light bulb the greater the amount of electricity used by the bulb. The same holds true when comparing fluorescent bulbs of different wattage.

Research Question 2: To answer this question, students will need to read the labels on the fluorescent bulb packages. The fluorescent bulb package will list information that compares the brightness of the fluorescent bulb to an incandescent bulb. These will contain statements such as "A 52 watt replacement for only 15 watts". This statement was printed on a 15 watt fluorescent bulb package. This means you could compare the electricity used by a 15 watt fluorescent bulb to a 60 watt incandescent bulb, since they would be approximately equal in brightness.

It is unlikely that you will be able to find incandescent and fluorescent bulbs of the same wattage. However, approximate comparisons are possible. For instance, in the above example students could compare the electricity used by a 60 watt incandescent bulb with that used by a 15 watt fluorescent bulb.

Conclusion: Fluorescent bulbs use much less electricity than do incandescent bulbs of similar brightness.

Summing Up:
1. See conclusion statements under sample data section.

2. Student answers will likely vary, but might include reference to energy savings. Most fluorescent packages list the watt rating of the fluorescent bulb and the watt rating of the incandescent bulb of similar brightness. Many fluorescent bulb packages will also list environmental advantages of using fluorescent bulbs. This might include the amount of carbon dioxide emission which is reduced as a result of the electricity savings from the light bulb. Many fluorescent bulb packages will also approximate the amount of money saved by replacing an incandescent bulb with a fluorescent bulb. Encourage students to translate the more technical information on the packages into more easily understandable language.

3. Student answers to this question will vary. Students will likely include mention of the use of fluorescent lighting in high use areas and using low wattage bulbs in areas such as stairwells and closets, where brightness is not very important. Make certain that student answers contain factually correct suggestions.

Extensions:

- Invite an interior designer to speak to the class and discuss the importance of lighting. It would also be appropriate to ask an architect to explain how he/she decides where to place windows and lights in homes.
- Recommend some lighting changes for your home. Present your recommendations to your parents. With your parent's permission, make the recommended changes. Ask the adults in your home to write their reactions to the changes.
- Math Connection: Ask students to prepare a graph representing the data they gathered about wattage and brightness. Think about what type of graph would be the best way of presenting your data.
- Language Arts Connection: Because it has always been here for us, many people tend to take lighting for granted. Write a short story about "The Week the Lights Went Out." What effect would such an event have on your life?

Lumen Essence

Student Page

Our life would surely be different without the use of electric lights. Modern lighting is something that is taken for granted by most of us. Many people don't really understand much about lighting and, consequently, tend to waste a lot of energy by their lighting practices.

You have undoubtedly heard the term "watt". But do you know what this term really means? The watt number gives you some valuable information about light bulbs. There are factors other than the light bulb's wattage that can affect lighting in your home. The type of room, location of lamps, type of light bulbs, to name a few, can affect how bright a light bulb seems. In this activity you will discover ideas that will help you to provide some useful advice to homeowners about how to use lighting more efficiently.

Materials:
lamp
hot mitts
fluorescent light bulbs
incandescent light bulbs
electric utility meter
clock with second hand

SAFETY WARNING:
Always unplug the lamp before replacing a light bulb. Remember, the bulbs will be hot after use. Allow them to cool for several minutes before changing bulbs. Use hot mitts when handling warm bulbs.

Let's Investigate:
Devise a plan for answering each of the two research questions posed below. You will be using an electrical meter to collect the data needed to answer the questions. Your teacher will explain how to operate the meter. Be very careful when using the electrical meter, as it is breakable! Experiment with the meter until you feel comfortable that you know how to take a numerical reading from the device.

Describe exactly what you plan to do for each research question. Make your own data table. Remember, in any well designed experiment, you must be careful to change only one variable at a time! Before beginning to collect data, ask your teacher to check over your procedures and data tables.

Research Questions:
1. What is the relationship between the amount of electricity used by a light bulb and the watt number on the bulb?

2. How does the amount of electricity used by a fluorescent light bulb compare to the amount of electricity used by an incandescent bulb of approximately the same brightness? (Hint: the fluorescent bulb package will list information that compares the brightness of the fluorescent bulb to an incandescent bulb. For example, a 15 watt fluorescent bulb package reads "52 watt replacement for only 15 watts". This means you could compare the electricity used by a 15 watt fluorescent bulb to a 60 watt incandescent bulb.)

Summing Up:
1. Write conclusion sentences for each research question.

2. Read the packages of both incandescent and fluorescent light bulbs. What information on the packages do you think is most important? Translate this information into easy-to-understand statements that the average person, without a science background, can understand.

3. Imagine that you have been hired as a "lighting expert" for a family that is building and decorating a new home. Name at least three pieces of advice you would give the homeowners on how to get the most lighting for their money.

Slipping Through the Cracks

Teacher Notes

Objective:
Students will be able to describe methods to test for air leakage and will be able to describe the common areas air can leak into and out of buildings.

Materials:
tissue paper
long pencil
feather tester

Suggested Teaching Strategies:
Student directions for this activity are provided. If you would rather not distribute copies of these pages to each student, you may wish to present the problem orally.

Students will get the most accurate results if data is gathered during the cold, winter months. A windy day anytime between December and March would be ideal. The accuracy of student findings will be increased when classroom doors and windows are kept closed. It would be great if some students could be allowed to test outside doors around the school building. If feathers are not available, thin strips of wrapping-type tissue paper will give adequate results.

Some students may have difficulty holding their hands steady while testing for drafts. To help alleviate this problem, suggest that students tape the feather or tissue paper to the wall or floor near doors and windows they wish to test. Students should devise their own data tables. They will need to devise a method to indicate the strength of the air currents resulting from leaks.

Background:
Many people in Iowa have the potential to cut their home heating bills by 50% or more. This can be accomplished with a logical, well planned approach that does not have to cost a lot of money. Every home should be sealed and then insulated. Air leakage usually amounts to 30-40% of your heating bill. Stopping air leakage is not only important for energy savings and comfort, but also to protect your home from the damaging effects of moisture. Air leaking into the exterior walls from the interior of the home carries humidity with it. This can cause condensation. The condensation gets the insulation wet and could eventually cause the surrounding wood to rot.

Heat can be lost through electrical outlets and switches. Most leakage occurs on outside walls, but even on inside walls pressure differences may draw air from the room through the outlet and up the partition to the attic space. Consider installing electrical box inserts and foam gaskets.

Sample Data:
Student data will differ greatly depending on your classroom and school. If students are using all three modes of testing, they will likely indicate a preference for the feather. All three modes will give good results. There is no one "right" answer for which mode of air current detection is best.

Sample Answers to Summing Up:
1. Student answers will vary, but will likely mention the difficulty of controlling "breezes" generated by students moving around the room. The amount of air leakage is also affected by the outdoor temperature and by the wind. If data is collected on a warm, calm day it may be difficult to detect leaks.

2. Student answers will vary. Make certain that students logically defend their choice.

3. Student answers will vary, but will likely include low cost improvements such as caulking, weather-

stripping and sealing windows with plastic wrap. Turning down the thermostat, especially at night, should also be suggested.

Extensions:

- Imagine you are the weather person on the local television station. You have been asked to explain wind chill and heat index to a group of 5th graders. How would you go about explaining these two concepts in terms the students could understand?
- With the help of an adult in your home, place caulking around a leaky door or window, or plastic wrap over a window in your home. Test for leaks both before and after. How do your test results compare?
- Technical Reading/Writing: Write a set of directions describing how to caulk a leaky window or how to install insulation on electrical outlets.

Slipping Through the Cracks

Student Page

By far the biggest part of the average home's energy budget is spent on home heating. Leaks can account for 20-30% of an average home's heat loss. That's why we will devote this investigation to locating air leaks and making suggestions on how to close up those leaks.

Before you can give homeowners advice on sealing up unwanted air leaks, you need to learn how to locate these leaks. While guests always enter your home through the front door, this is not so with air leaks. Energy-wasting drafts can come creeping in where you least expect them, like through the electrical outlets in your home!

Materials:
tissue paper
long pencil
feather tester

Let's Investigate:
While "feeling a draft" is common on a cold and windy winter day, drafts are likely present in your home during most seasons. Drafts are caused not only by wind from outside your home, but by mini air currents that result from temperature differences within and outside your home. A draft can be detected by holding a very light object near the area you wish to test. For example, if you hang a thin piece of tissue paper over a long pencil, the paper will move as a result of very slight movements in the air. The same is true for a feather.

Using tissue paper and a feather tester, develop a plan for testing different areas in your classroom for air leaks. Devise your own system for recording the amount of air leakage. In addition, determine which method of testing (tissue paper or the feather) provides the best information on air leaks. Ask your teacher to check your plan and data table before beginning the data collection. have been approved. Remember it is very important to control as many variables as possible in conducting your experiment.

Summing Up:
1. Describe problems you may have experienced in controlling the variables in your experiment.

2. Which method of testing do you believe provides the best information on air leaks? Explain your

choice.

3. Your winter heating costs are straining your school's budget. Based on the results of your experiments, recommend a plan for reducing energy losses in your school.

Watch Your Watts

Teacher Notes

Objective:
Students will be able to describe a method which can be used to directly measure the amount of electricity different appliances use and will be able to order most common appliances in terms of the amount of electricity each consumes.

Materials:
electrical meters
timers or wall clock with second hand
variety of appliances

Safety Warnings:
As with any electrical outlet, students should be cautioned not to insert any objects into the outlets. It is best if students keep the meter unplugged until the appliance to be tested has been plugged into the meter. The aluminum cover plate should not be removed from the meter. If it is, the glass cover will become unattached and may be damaged.

Suggested Teaching Strategies:
Student directions for this activity are provided. If you would rather not distribute copies of these pages to all students, you may wish to present the problem orally. This activity requires the use of electrical meters. These may be purchased from most local utilities for a nominal fee. Appendix A contains instructions for converting the meters for class use.

You may wish to have students bring their own appliances to school for testing. If this becomes a logistical problem, have a number of items available for students to test. It is best if these items are examples of appliances typically used by middle school students (i.e., hair dryer, radio, lamp, television etc.) It is important for students to gather data on several larger appliances as well (i.e., microwave, washer, dryer, dishwasher). Arrange a visit to the home economics room or the physical education laundry facilities. Measurements of these larger appliances can be taken at that time. The most consistent results will be obtained when testing appliances that have a definite on-off switch. Appliances with a thermostat (coffee makers, refrigerator, water heater) do not draw current at a steady rate.

Before beginning the data collection process, remind students to make a data table in which to record their findings. Remind students to "zero" the meter before collecting data. This is most easily done using a hair dryer to move the dial quickly to a convenient starting location. Each reading must begin with the dial in the same place.

Background:
The number of watts consumed by light bulbs and appliances is marked on the name plate of each device. If not marked in watts, they are marked in amperes (AMPS). To find the watts, multiply AMPS

times volts. For example, an appliance rated 3 amps multiplied by 120 volts would be 360 watts.

Watts = Amps x Volts

The electrical utility company measures energy consumption in kilowatt-hours (KWH). A kilowatt-hour is equal to one kilowatt of power consumption, multiply the wattage by the number of hours or part of an hour the appliance is used. This number (watt-hours) divided by 1,000 gives kilowatt hours.

KWH = (wattage x hours used) / 1000

The average wattage rating of common household appliances is listed in Appendix A, along with the estimated kilowatt hour usage per month for an average family of four.

If the electrical meter you are using in your classroom is rated at 1.8 Kh, this means that one rotation of the disk will equal 1.8 kilowatt hours of electricity. If the meter is rated 3.6 Kh, one rotation of the disk equals 3.6 kilowatt hours.

Summing Up:
1. Student ratings will vary depending on the appliances tested. Rankings of appliances should appear from lowest watt rate to highest watt rate recorded on the back of each device.

2. The higher the watt rating on an appliance, the more electricity the appliance consumes each minute of operation.

3. Use Your Math: Student answers will vary depending on the appliances tested and their individual family situations. To determine the total number of dial spins, students should multiply the number of spins per minute by the estimated number of minutes per day the appliance is operated.

Authentic Assessment:

- Ask students to make a list of at least six appliances they would like to check in their home. These measurements will likely need to be done during class time, as it would be difficult to allow students to take the meters home. However, most utilities have meters that can be "checked out" to the general public on a weekly basis. Some of your students may be interested in checking out a meter for use in their home.
- Challenge students to discover how the different settings on a hair dryer compare. Do all of the settings consume the same amount of energy?
- Challenge students to discover if rechargeable items continue to draw current at the same rate. Does a nintendo game draw current when it is not being used?
- Ask students to find the electrical meter in their home. Observe it at three different times during the day. Make a record of the number of rotations per minute and of which appliances in their home are operating at the time. Can they get the meter to stop turning by switching off appliances?
- Technical Reading: Ask students to do some research to discover how to install an insulating blanket on a hot water heater and how to insulate the pipes of the heater. Challenge students to write clear directions for the average homeowner, designed to explain how to insulate the hot water heater and its pipes. Make a diagram to accompany their directions. Ask students to include safety suggestions for the installation process.

Watch Your Watts

Student Page

Your water heater probably takes close to 20% of your home energy dollar. This is followed by other large appliances such as the refrigerator, stove, dishwasher, washer and dryer. You may be wondering how the amount of electricity used by these large appliances compares to that used by smaller appliances. What about all of those computer games you play and all of those long hours in front of the TV? In this investigation, you will be able to discover answers to these questions.

Materials:
electrical meter
stop watch
appliances of your own choosing

Safety Warnings:
Do not insert any foreign objects into electrical outlets. Keep the meter unplugged until the appliance to be tested has been plugged into the meter.

Let's Investigate:
You have seen electrical meters similar to the one you will be using for this investigation. This is just like the meter attached to the outside of your home. Each month the "meter reader" comes by to read the amount of electricity your family has consumed. These readings are in kilowatt hours. Many people don't realize that use and overuse of even the smallest appliances can increase your total electrical usage. In this investigation you will be able to make comparisons of the relative amount of electricity needed to operate both large and small appliances.

Decide which appliances you would like to test. Your choices depend on what appliances you or your classmates are able to bring to class and on those your teacher may have available. You may be able to get permission to visit the home economics classroom to test some larger appliances. Prepare a data table containing columns for the appliances to be tested, the watt rating listed on the bottom or back of each appliance, and the number of rotations of the dial on the meter each minute. Ask your teacher to check your data table before you begin testing each appliance.

Summing Up:
1. Rank the appliances tested in class from least amount of energy used to greatest amount of energy used.

2. Study the findings recorded in your data table. Describe the relationship between the amount of electricity used and the watt rating recorded on the bottom of each appliance.

3. Use Your Math: Estimate the number of minutes per day your family uses each of the appliances tested. Based on these estimates, calculate the number of dial spins each of the appliances tested would undergo in your home each day. Be sure to clearly show your calculations.

Be a Waste Watcher!

Teacher Notes

Objective:

Students will be able to explain how to test for water waste and can explain to others, several areas in the home in which water can be used more efficiently.

Materials:
graduated cylinder (50 mL & one larger)
timer or any clock with a seconds hand
toothbrush (kids bring their own)
2 L pop bottles
buckets or other large plastic containers
calculators

Suggested Teaching Strategies:
Students need to devise a plan for collecting and measuring water. Please refrain from telling students how to set up the experiments. Students need experiences designing their own investigations and then implementing their plans. The time periods over which students will decide to collect data will differ from group to group. It will be easier for students to analyze their data if they use the same time for both the fast and slow dripping faucet. Let students discover this on their own. Time is an important variable to control in this portion of the experiment.

It will be difficult to compare student data between groups, as each group will have a slightly different idea of what fast and slow drips are. This is OK. The point is still well illustrated that a leaky faucet can waste a tremendous amount of water over time.

In the tooth brushing portion of this investigation, students will likely decide to catch the water that runs from the faucet in a container while they are brushing their teeth. The volume of this water can then be measured using graduated cylinders. It may be helpful to have students pour their water into 2 liter pop bottles to better illustrate the amount of water wasted.

Don't be tempted to suggest that all student groups in the tooth brushing experiment attempt to brush their teeth for the same length of time. Ask students to brush for about as long as they do at home. This will obviously vary with each student. In this same experiment, when students brush with the water off, this does not mean that they may use no water. Students should use water to wet their brush and to rinse at the end. This amount of water should be captured and measured using a graduated cylinder.

If your classroom does not have easy access to multiple sinks, you can easily rig a drippy situation. Fill a number of plastic milk jugs with water. Use a small needle to poke a hole in the side of the filled jug, toward the bottom. The water will run down and drip off the bottom of the jug. Set the leaky milk jug over the edge of a table. Place a plastic tub below the drip to catch the spills. Experiment with the hole size until you get several drip speeds with which you are happy. Students can then rotate to the different jugs, collecting data as they go.

Background:
There are many good reasons for saving water. Applied nationally, household water efficiency programs would save billions of gallons of water each day. Most people do not realize that in the typical home, about 75% of the indoor water consumed, is used in the bathroom, 20% in the kitchen and laundry and 5% for cooking and drinking.

A hot water faucet that drips one drop each second can waste as much as 9,600 liters (2,100 gallons) of hot water each year. By installing an aerator on your kitchen faucet, you can significantly cut water consumption...from 25 liters to 14 liters per minute. Aerators mix air with tap water to significantly reduce the flow of water. The user consumes less water, while it seems as though the same amount is

coming out as before.

The water heater is typically the second largest user of water in the house. Most people use a lot less water taking showers than baths. The temperature of many water heaters may be set too high. Between 55 and 60 deg C (131 - 140 deg F) is an ideal temperature range. At these temperatures you will avoid scalds while saving energy. To test the hot water heater's temperature, run the hot water tap that is closest to the heater. After a few minutes, check the temperature of the water with a thermometer. Most water heaters have an easily visible temperature setting dial. If there's no external dial, homeowners can call their fuel supplier to have someone come to reset the temperature.

Summing Up:
1. Student answers will vary depending on the speed of the leak and the amount of time over which the data was gathered.

2. Student answers will vary. Expect students to get answers ranging from 1-4 liters of water saved per tooth brushing.

3. Use Your Math: To calculate the amount of water saved yearly by changing tooth brushing habits, students will likely use this reasoning: *water saved = liters saved/brushing x number of brushing episodes each day x 365 days per year.*

4. Use Your Math: This answer will vary depending on the size of each student's family. To determine the savings multiply student's answer from #3 by the number of family members who brush. This assumes each person brushes for the same length of time and the same number of times each day.

5. Use Your Math: The number of liters of water wasted each year by a slowly dripping faucet can be determined by multiplying the *liters lost in 1 minute x 60 min/hour x 24 hour/day x 365 day/year.*

Authentic Assessment:
Suppose you are an employee of the local water plant. The plant needs to reduce water use or they will be forced to drill an expensive new well. Design a publicity campaign for this purpose. Use the results of your experiments to support your campaign.

Extensions:

- There are lots of showers taken in the school locker rooms each day. Take a look at the shower heads. Determine if they are low flow shower heads. If not, devise a method of determining the approximate amount of water used daily in the shower rooms of your school. Then calculate the amount of water your school would save by installing aerators in the shower rooms (assuming the aerators would cut water consumption from 25 liters/minute to approximately 14 liters/minute. Present your findings to the school board.
- Challenge students to design an experiment to determine whether more water is used taking a bath or taking a shower. If they really want to get creative, try to figure out exactly how many gallons of water they use taking a bath and how many gallons they use for an average shower. Ask students to write a short report describing their experiments and what they discovered.
- Math Connection: Calculate the amount of water that could be saved if all of the people in your city/town turned off the water during tooth brushing? Show your calculations.
- Technical Writing/Reading: Challenge students to develop an easy set of directions for installing a low flow shower head.

Be a Waste Watcher!

Student Page

Washing clothes in cold water, cleaning out the lint trap in your clothes dryer, closing the drapes at night, and turning off the water while brushing your teeth seem to have an insignificant relationship to energy use. However, when many little steps are taken to use energy more efficiently, a big savings can be realized. In this activity, you will see how a little drip can lead to a big waste. Imagine what a difference in energy use it would make if you could convince people to change some of their energy wasting behaviors!

Materials:
graduated cylinder
toothbrush
timer
empty 2 L pop bottle

Let's Investigate:
Experiment and discover the answer to these three questions:
1. How much water is wasted by a slowly dripping faucet?
2. How much water is wasted by a fast dripping faucet?
3. How much water could you save by turning off the faucet while brushing your teeth?

For each question, devise an experiment that will allow you to collect data and formulate a good answer to the question. Write several sentences describing exactly what you plan to do in each investigation. Prepare a table in which to record the data. Before beginning to collect data, ask your teacher to check over your procedures and data tables.

Summing Up:
1. Summarize what you discovered about the amount of water lost by a slow and fast leaking faucet.

2. Summarize what you discovered about the amount of water lost during each tooth brushing.

3. Use Your Math: Use your data to calculate how many liters of water you would save each year by turning off the faucet while brushing your teeth. Be sure to show your calculations.

4. Use Your Math: How much water could be saved if each of your family members turned off the water while brushing?

5. Use Your Math: Using your data, determine the number of liters of water you would waste in one year with a slowly dripping faucet. Again, be sure to show your math calculations.

Taking the Message Home

Teacher Notes

Objectives:

Students will be able to do at least one of the following:

- Identify and explain to others those areas in the home in which lighting is being used efficiently and those areas in which lighting efficiency can be increased.
- Explain why air leakage is a source of energy waste in homes and identify and explain to others those areas in the home in which air leakage is typically a problem.
- Identify and explain to others those areas in the home in which appliances can be used more efficiently.
- Identify those areas in your home in which energy is being used efficiently and those areas in which energy is being used inefficiently.

Suggested Teaching Strategies:
In this activity, students will be using the information they have learned regarding lighting, appliances, air infiltration and water savings to prepare a detailed study of energy use in their home. There are a variety of approaches which can be taken to accomplish the goals of this activity. One suggestion is to give students an overview of what is expected in each of the four areas: lighting, air infiltration, appliances, and energy wasting behaviors. Assign students to complete the data collection and analysis in one of these four areas. Each of the activities requires that students collect data at home, that they write a summary letter to their parents based on the data they collect and on information contained in the Guide for Energy Efficieny Practices (EEP). Some teachers may wish to require students to make an oral presentation to the adults in their home. If this approach is taken, you may wish to consult Appendix A for a sample letter home regarding the home presentation and an evaluation sheet that may be used by parents during the presentation.

In all cases, students will rely heavily on information contained on the EEP (Energy Efficient Practices) (see Appendix A). This is merely a collection of energy saving tips that are organized in categories that are similar to the groupings studied in the first four activities; lighting, appliances, air infiltration, and energy efficiency behaviors. Before students make their choices as to which area they wish to study, review the sections of the EEP with students. It is vital that students use this as a valuable source of information, especially in writing their summary report to parents. Remind students that they have the opportunity to influence the energy related behaviors in their homes. It is important that they give their family members good advice. Using the information on the EEP will help ensure that students are communicating factual information to their families.

Home Inventory 1: Lighting
Students will be collecting data on the number of light bulbs and the wattage of the bulbs in each room of their home. While this assignment may seem overwhelming to students, with an organized approach, it can be completed in a rather short amount of time. It is important that students collect and record their data in an organized fashion. Give students an opportunity to come up with their own design for a data table. This could be accomplished by students working in small groups, or as a result of class discussion.

The largest savings can be realized by installing fluorescent bulbs in areas of high use. This might include the kitchen, living room, dining room and bathroom. Student choices will likely vary. Remind students that fluorescent bulbs will not fit into some ceiling light fixtures and that they are not recommended for lights equipped with dimmers.

Make certain that student letters to parents are specific in content. Rather than simply recommending switching to fluorescent bulbs, name those rooms in which the changes should be made and explain why. Remind students that their letter should be aimed at convincing their parents that some changes should be made. Students should also be reminded to include positive comments indicating those efficient lighting practices which were observed.

Home Inventory 1: Lighting
Student Assignment

1. Conduct an inventory of the lighting used in your home. List the number, room, and wattage of every light bulb being used in your home. Make an estimate of the number of minutes each light is turned on each day. Present your data in an organized chart or table.

2. In which locations of your home do you think it would be economical to switch from incandescent bulbs to fluorescent bulbs? Explain your choices.

3. Study the section devoted to lighting on the EEP Sheet (Energy Efficient Practices). Using suggestions described on the EEP, analyze the lighting data from your home. Write a short letter addressed to your parents/guardian describing the current strengths as well as opportunities for more efficient lighting use in your home. Name locations in your home which you would recommend use of low wattage light bulbs. In what places are brighter lights preferable? Try to be as specific as possible in your report!

Home Inventory 2: Air Infiltration
Before students begin collecting data at home, make certain they have prepared a data table to record their data. They should think about those areas they wish to test, but leave blanks for testing additional areas of their home. Suggest students read through the suggestions on the EEP sheet related to air infiltration. This will give them an idea of areas in their homes which they should check for leaks.

Make certain that student letters home are specific in content. Rather than simply recommending that caulking and weather-stripping be done, students should specifically note those areas of their home in which they discovered air leaks. Once again remind students that their letter should be aimed at persuading their parents that some changes should be made. Encourage students to include positive comments about those areas in which they did not find air leaks in their home.

Check student plans for accuracy of content. Encourage students to organize the information from the EEP into an easily understandable form.

Extension: (Math/Industrial Technology Connection) Ask students to draw their house to scale. On their drawings, ask them to show where the leaks are located and indicate where those places are which appear to be tightly sealed.

Home Inventory 2: Air Infiltration
Student Assignment

1. Prepare a plan for gathering data on air leaks in your home. Use the feather or tissue paper for your testing. If you have a fireplace, test it both with the damper closed and with it open. Be sure to check exhaust fans (while they are turned off) and electrical outlets along the outer walls of your home. Present your data in an organized chart or table.

2. Study the section devoted to air leakage on the Energy Efficient Practices (EEP) computer program. Using suggestions described on the EEP, analyze the data you have collected. Write a letter to your parents telling them the good news and the bad news about the air leaks. Try to be as specific as possible.

3. Using ideas from the EEP, write a short plan for eliminating the drafts in your home. Attach this list

to the letter to your parents.

Home Inventory 3: Appliances
Provide students with copies of the Home Appliance Survey. (See Appendix A) Review the survey with students before they begin collecting data at home. Make certain that they understand what they are to look for around their home.

Make certain the letters students compose are specific in content. Rather than simply recommending that the dishwasher be filled before using it, provide some concrete suggestions that really fit the family. Suggest a "best time of the day" for the family to use the dishwasher, if at all. Once again remind students that their letter should be aimed at persuading their parents that some changes should be made. Students should be encouraged to include positive comments indicating those areas of appliance use that appear to be efficient.

Check student plans for accuracy of content. Encourage students to organize the information from the EEP into an easily understandable form, making certain that suggestions are given that fit each family situation.

Home Inventory 3: Appliances
Student Assignment

1. Conduct an appliance survey of your home. You teacher will give you a survey to take home. Answer all of the questions posed on the survey. In some instances you are instructed to ASK your parents/guardians for answers to the questions. In other cases, you need to LOOK at the appliance and find the answer for yourself. In cases where your home does not have the item indicated (like air conditioning), write a note to that effect on your survey and simply do not complete that section of the survey.

2. View and study the section on the Energy Efficient Practices (EEP) computer program devoted to appliances. Using suggestions described on the EEP printout, analyze the data you have collected. Identify those areas in your home in which appliances could be used more efficiently. Suggest possible changes in practices that could increase the efficiency efficient use of appliances in your home. Write a letter home telling the good news and the bad news about your appliances and how your family uses them. Try to be as specific as possible.

Home Inventory 4: Energy Waste
Review with students the Energy Efficiencies Survey, Appendix A, before they begin collecting data at home. Make certain that they understand what they are to look for.

Check to see that student letters to parents are specific in content. For example, rather than simply recommending that less water be used in the bathroom, provide specific suggestions for cutting water bathroom use. Once again remind students that their letter should be aimed at convincing their parents that some changes should be made. Students should be encouraged to include positive comments indicating those areas in which energy is being used efficiently.

Check student plans for accuracy of content. Encourage students to organize the information from the EEP into an easily understandable form, making certain that suggestions are given that fit each family situation.

Home Inventory 4: Energy Waste

Student Assignment

1. Conduct a survey of your home to determine what impact individual behaviors have on energy consumption. Take the attached survey home and answer all of the questions posed. In some instances you will need to ask your parents/ guardians for answers to the questions. In other cases. you may need to look and discover the answer for yourself. In cases where your home does not have the item indicated (like air conditioning), write a note to that effect on your survey and simply do not complete that section of the survey.

2. View and study the section on the Energy Efficient Practices (EEP) computer program devoted to energy waste. Using suggestions described in the EEP printout, analyze the data you have collected on the survey. Identify those areas in which the energy use behaviors of those in your home could be used more efficiently. Suggest possible changes in behaviors that could increase energy efficiency. Write a letter home telling the good news and the bad news about your family's energy use behaviors. Try to be as specific as possible.

Table of Contents Previous Section Next Section

MATHEMATICS ACTIVITES

Watts the Charge?

Objectives

1. Students will be able to systematically collect, organize, and describe data through construction and interpretation of graphs.

2. Students will be able to make inferences, formulate convincing arguments and evaluate those arguments based on data analysis.

3. Students will gain an appreciation for statistical methods as a powerful tool in decision-making.

(These objectives coincide with National Council of Teachers of Mathematics Standard #10: statistics for grades 5-8.)

Module Overview - Mathematics

In the mathematics portion of the "You Make It Happen" module students study how energy use varies over time. Monthly utility bills covering a one year period provide data for student analysis. Students construct and interpret graphs of monthly energy usage. They then practice making inferences and developing convincing arguments based on their data as to the causes of monthly fluctuations in energy use.

For activities 2 and 4, you will need multiple copies of utility bills spanning a one year period. To make this unit most realistic for students, it would be best if each student could bring a copy of their family's monthly utility bill for the past year. These utility bills will then serve as the data base for several activities. Approximately one week before beginning the energy unit, send a letter home with students asking for monthly utility figures (See sample letter in Appendix B). Have sample utility bills available for students who are unable to bring their own bills. While a 12-month sample is provided in Appendix B, it would be best to secure bills from your own local utility, as the format differs with each company. You may be able to get sample bills covering a one year period from your local utility. Ask for bills representing a variety of situations. For example, from a grain farmer, a large family, an apartment, a large home and a small home. This will provide students with a variety of data from which they may make inferences about energy consumption patterns.

Throughout this module, students should be given the opportunity to work in small groups. It is suggested that the group size be kept at two students and that all students make their own graphs, rather than making graphs as a group. This will help to ensure maximum involvement by all students.

Extensions:

- Ask students to compare the yearly utility bills for an urban dwelling with that of a rural dwelling.

Outline the differences and come up with possible explanations for the differences.

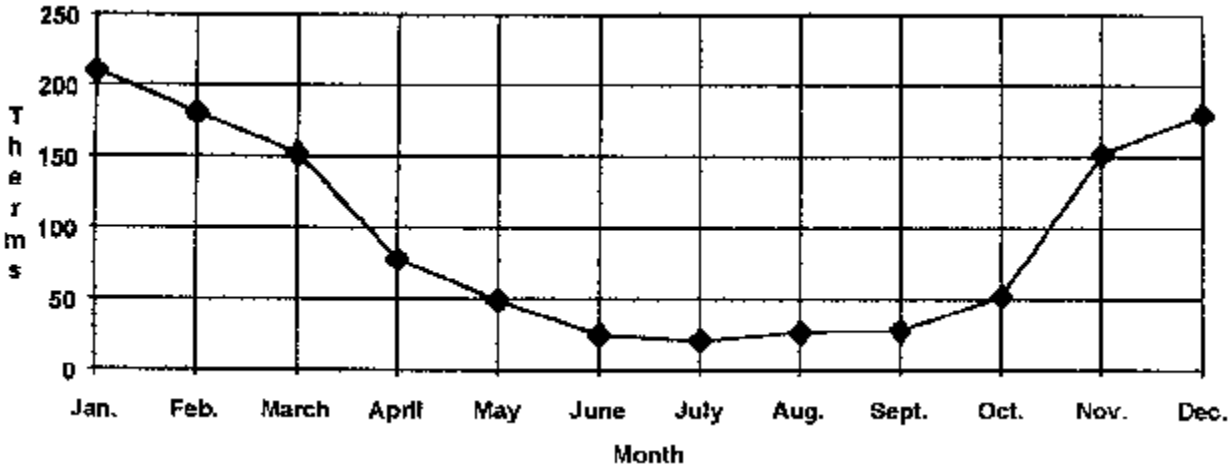
- Compare energy use between Iowa and Texas (north vs. south), Iowa to Oregon (midwest vs. west), energy use in U.S. to a third world country.
- Technical Reading: Contact your local utility office to obtain a copy of their informational brochure on "how to read your utility bill". Ask students to read through the brochure and point out those areas that are explained well, and those which are confusing. How could the explanation be changed to make the confusing statements more clear?

Suggested Authentic Assessment:

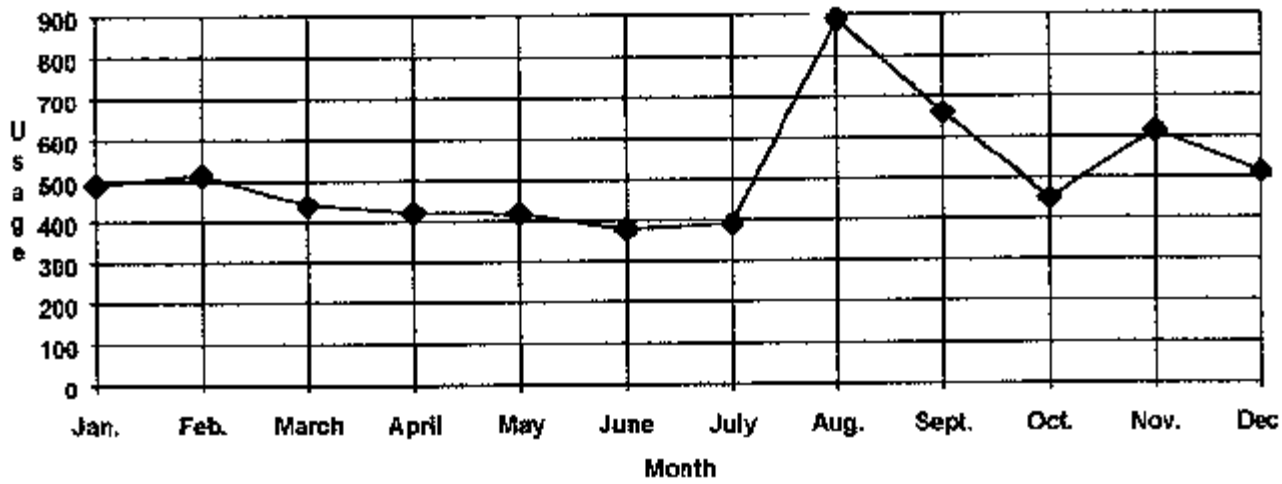
Each of the five questions posed below could be used as an authentic assessment measure following completion of the 4 activities.

1. A new family has moved into your school district. Explain in writing what they need to know to understand their utility bill. (Purpose: to evaluate student's ability to interpret a utility bill)

2. The following graph is an example of annual energy usage in the form of natural gas. What conclusions can you make from this data? (Purpose: to evaluate the student's ability to make inferences and interpret graphs.)



3. The graph below shows the annual electrical energy use of a sample household. What conclusions can you make from this data about the household's electricity use behaviors? Be as specific as possible in trying to explain the monthly fluctuations in electricity.



4. Create a January through December graph/record of energy use based on the scenario presented below.....extra fun: circle any energy terms you find in the paragraph (Purpose: to evaluate the student's ability to use written material to develop graphs)

```
The D.C. Watts are a family of four currently living in our community. Their home
has electric heat and air conditioning. They had a shocking experience in July when
their grandparents, Mr. and Mrs. A.C. Lumens, came to spend the entire month with
them. Fortunately, they brought their own mobile home in which to stay.
Unfortunately, they plugged their mobile home into the Watt's power supply. The D.C.
Watts were powerless in their efforts to get them to shorten their stay. Although it
was an enlightening experience, the family needed to re-charge so they surged ahead
on a three week vacation that included stops at the Hoover Dam, the oil fields of
Texas, the turbine valleys in California and other illuminating places. After
completing this circuit, they returned home. The remainder of the year was normal in
regard to temperature and precipitation. However, the month of January generated the
coldest temperatures on record.
```

Bill Me

Teacher Notes

Objective:
List at least five different types of information which are contained on a local utility bill.

Materials:
local utility bills (one copy per student group)
It would be best if each group is given a different bill. You may secure copies of local utility bills from your local utility, or may wish to use some of the bills which students have brought in from their homes.

Suggested Teaching Strategies:
Give each group of students a copy of a local utility bill (one month only) along with the student worksheet entitled "Bill Me". Directions are provided on the student worksheet. You may wish to save on paper copies by presenting students with an overhead of the problem (Let's Investigate) and the

Summing Up questions.

After students have been allowed some time to work on the Let's Investigate, get student groups to share their ideas. Generate a class list of the information provided on a utility bill. Remind students to make additions to their own lists as each group shares their ideas.

Discuss student answers to the "Summing Up" questions. Be sure to ask students to give reasons for their answers. Students should have had a great deal of difficulty coming up with good guesses to these questions. They simply do not have enough data to answer the questions. The point of asking these questions at this stage is to allow students to come to the realization that they can not make very good inferences based on this limited amount of data. One month's energy consumption does not allow students to see a pattern.

Bill Me

Student Page

A utility bill contains a lot more information than how much money you owe for your energy consumption. By closely examining a typical month's bill, you can see the types of information which the bill gives you about energy use patterns.

Let's Investigate:
Exam your copy of a utility bill. As a group, make a list of the types of information the bill provides. List even the most obvious things.

Following the class discussion, make additions to your group's list to reflect the ideas that were added from your teacher and other members of your class.

Summing Up:
Based on the data contained on your sample utility bill, answer the following questions:

1. Do you think the owner has gas or electric heat? How can you tell?

2. Do you think the owner has a gas or electric water heater? How can you tell?

3. How many people do you think live in this home? Why?

4. Do you think this home has air conditioning? How can you tell?

What's Your Energy Pattern?

Teacher Notes

Objective:
Graph energy consumption based on data contained in monthly energy bills and formulate inferences about the target home.

Materials:
12-month supply of utility bills (One per student group)
You will need one set of bills per student group. Each set of bills should be from the same household. Use the bills which students have brought from their homes. Make certain that you have extra sets available in case some students are not able to bring their bills from home.

Suggested Teaching Strategies:
Break students into think pairs. Give each pair of students a one-year collection of utility bills along with the student page for this activity. Directions are provided on the student worksheet. You may wish to save paper by presenting the problem (Let's Investigate) and the Summing Up questions on the overhead.

Please refrain from telling students which data should be graphed and which types of graphs would be most appropriate for this data. One of the major benefits of this investigation is that students are able to discuss the pros and cons of different types of graphs. Not all groups will make the same types of graphs. This will make for interesting discussion following completion of the "Summing Up" questions.

After the graphs have been completed, analyze and discuss the range (highs and lows) and the mean or average values. It is likely that some groups will have prepared bar graphs and others line graphs. Some groups may have decided to prepare pie graphs. Have groups display their graphs and discuss their reasons for choosing a particular type of graph. Perhaps a consensus can be reached about which graph most clearly illustrates the trends in energy consumption.

What conclusions can the students make from the data? Students were asked to answer the same set of questions posed earlier. This time, students should immediately realize that with more data, they are able to make more logical inferences. Students are also asked to notice when water consumption is highest and what might be the cause of the increased water usage? In most homes, water usage goes up during summer months due to increased use of water for watering lawns, washing cars, and other outdoor activities.

At the conclusion of this discussion, be sure to ask students why it was easier to devise answers to these questions with this additional data than it was with only one month's bill.

Sample Answers to Summing Up:
1. Student answers will vary, but will likely list bar and line graphs as the easiest way to illustrate the patterns on energy use.

2. If the sample bills have significantly higher gas consumption during winter months, it is likely that the home is heated with gas.

3. It will be more difficult for students to make a logical inference for this question since hot water is used with some regularity throughout the year. The important thing is to check student answers for logical reasoning.

4. This is a difficult question to answer, even with a year's worth of data. Students should realize that to answer this question, they might need to compare the bill to other homes and to also know the size of the home.

5. If the electricity usage goes up significantly during summer months, it is likely that the home has air conditioning.

6. If water consumption is highest during summer months, it might be a function of increased water usage for outdoor purposes such as watering the lawn and washing cars.

What's Your Energy Pattern?

Student Page

Utility bills are not standardized across the United States or even throughout Iowa. Some bills may not even include the same information. The electricity is measured in units called kilowatt-hours (the number of kilowatts in one hour). The utility company then charges a fee for each kilowatt-hour consumed. The fee can vary from place to place and from month to month.

Natural gas measurement may be expressed in therms representing 100 cubic feet or as mcf representing 1000 cubic feet. The utility company charges a fee for each therm or mcf consumed. Check your bill carefully to see which units are used.

Materials:
graph paper
ruler
utility bills
calculator
markers or colored pencils

Let's Investigate:
Your group has been given monthly utility bills covering one year for a local family. Your job is to come up with graphing techniques that will clearly represent the monthly changes in kilowatt-hours of electricity consumed. At this point we will tell you that the homeowners consist of a family who live in a house in a typical residential area. You will be surprised to learn that the collection of numbers on their utility bills can tell you a great deal about the family to whom this bill belongs. Use the data from your bills to prepare the graph. Prepare a second graph illustrating the monthly use of natural gas.

Summing Up:
1. Which type of graph (pie, pictograph, bar, line) do you think best represents the data? Explain your answer.

2. Do you think the owner has gas or electric heat? Why?

3. Do you think the owner has a gas or electric water heater? Why?

4. How many people do you think live in this home? Explain your reasoning.

5. Do you think this home has air conditioning? Explain your reasoning.

6. Notice when water consumption is highest. What might be the cause of the increased water usage?

Scattergrams

Teacher Notes

Objectives:
Prepare and interpret scattergrams.

Materials:
Student copies of utility bills(one-year supply) Use the same sets of bills students worked with in Activity 2.

Suggested Teaching Strategies:
This activity has no accompanying student page, as the procedure is best explained by the teacher. You may wish to begin with some of the discussion questions suggested below.

Do you think there is a relationship between energy consumption and number of people in a given household? Ask students to hypothesize as to whether the amount of energy consumed in a home is related to the number of individuals living in the household. How might these two factors be related? After students have made their predictions and stated their reasons for the suspected relationship, ask students how they might go about discovering if their prediction is correct. Hopefully students will suggest that they look at the amount of energy used by different families.

Explain how a scattergram (scatterplot) is set up and for what purposes it is typically used. Ask students to set up a scattergram relating amount of energy consumed and number of individuals living in a household. Set up a method of sharing the data that was collected from students' homes. Let students determine which numbers should be plotted. For example, they may want to sum all monthly consumption and graph the total yearly energy consumption. If they choose to ` graph consumption during one month only, they must all choose the same month. It is best that students discover these potential problems on their own, rather than having the teacher simply tell them what to plot.

Display the plots in a prominent area. Challenge students to look for patterns and to attempt to explain the reasons for the patterns. When income is not controlled, a clear pattern may or may not emerge. If no pattern emerges, students should be asked to explain the lack of a pattern.

Energy Highs and Lows

Teacher Notes

Objective:
Explain patterns of energy consumption in various homes given monthly utility bills.

Materials:
monthly utility bills (1-year supply per student)

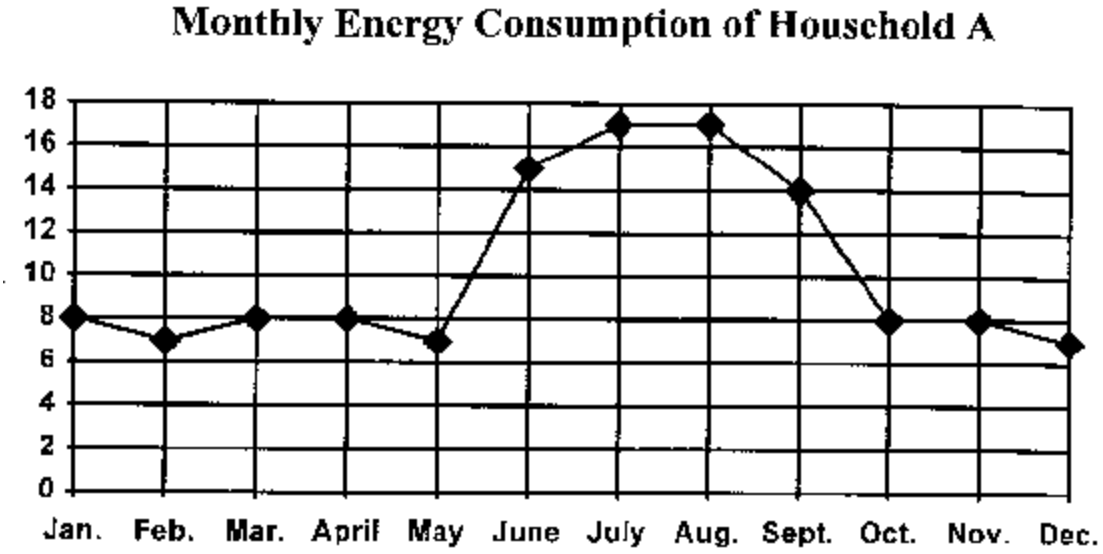
Suggested Teaching Strategies:
It is best to have each student work with the utility bills they have brought from their home. If this is not possible, give students an "extra set" of data. Try to secure utility bill data from some of the other teachers or administrators in your school. Student interest will remain higher if they know the person whose bills they are analyzing.

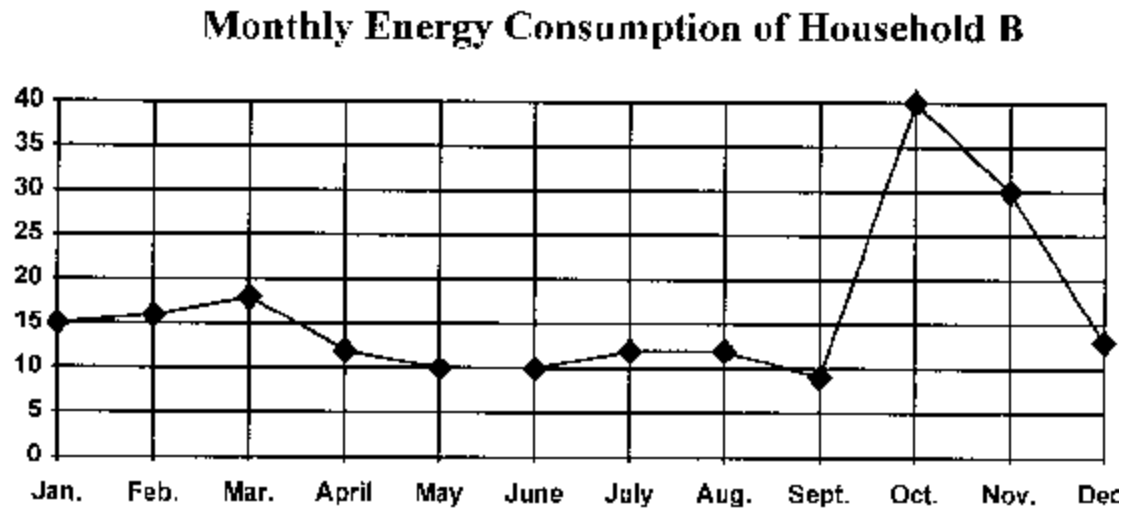
Break students into think pairs, such that each group has at least one person with a complete set of utility bill records. Give students copies of the students worksheet entitled "Energy Highs and Lows".

Students should be able to come up with some logical explanations for differences in electrical and gas energy consumption. Sharing data on the number of individuals living in their home, size of house or apartment, when it was built, types of appliances they have, and other personal use habits provides useful information for comparison. It would be preferable to have each student graph their own data, assuming enough students brought their data to class.

Sample Answers to Summing Up:
Student answers to the "Summing Up" questions will vary depending on their energy usage and on with whom they compare their graphs. Look for logic in student answers. It is likely that students will mention seasonal temperature differences as the major cause of the differences between high and low use of both gas and electricity.

Extensions/Assessment:
Challenge students to make inferences about the fluctuations in the energy use plots shown below.





In Household A, there is a marked increase in electricity use during the summer months. This is likely due to increased use of the air conditioning. Students should also be able to conclude that Household A has gas or fuel oil heat. This conclusion is based on the fact that the energy consumption does not increase during the cold Iowa winter months. If the heat was electrical, this would not be the case.

For Household B students should notice the large increase in energy consumption during the month of October and November on Graph B. This is a plot of energy consumption on a grain farm. During the fall months, much electricity is used in the grain dryer during harvest time. This accounts for the large increase in electricity during these months.

Challenge students to devise their own fictitious plots of energy consumption and to have other students make inferences about the causes if the energy consumption fluctuations in the plots. Encourage students to make a decision about the type of heating and cooling, the number of individuals in the household and their ages prior to preparing their graphs.

Energy Highs and Lows

Student Page

Now that you have become skilled at graphing data, it is time to try your hand at interpreting patterns in those graphs. Everyone's home energy use follows patterns. These patterns may be related to the weather, to the personal habits of those living in the home, or to a host of other factors. In this activity you will be looking for patterns in your family's energy use. You will then compare your family's energy use patterns to those of one of your classmates.

Materials:
graph paper
monthly utility bills from your home

Let's Investigate:
Prepare a graph of the monthly electrical use for your set of home utility bills. Prepare a second graph of your home's natural gas consumption.

Compare your graphs to those made by another student. Notice the overall pattern of highs and lows for your graphs and your classmate's graphs. Talk with your classmate about his/her home. Ask questions about the number of persons living in the home, the size of the home, when it was built, and the types of appliances they have. By comparing this information to your home, point out at least three similarities between the patterns on your graphs and those of your classmate. Come up with some reasons that would explain these patterns.

Describe at least three things that are different between your graphs and those of your classmate. What reasons can you think of to explain these differences?

Summing Up:
1. Locate the highest and the lowest months of electricity consumption. State at least three factors that you believe could have caused the energy consumption between these two months to differ so much. Please be specific.

2. During which month was gas consumption the highest and when was it the lowest? State at least three factors that could have caused the gas consumption between these two months to differ so much. Again be specific.

Table of Contents Previous Section Next Section

LANGUAGE ARTS ACTIVITIES

Producing a Video on Energy Using Persuasive Techniques

Objectives

Students will write, direct, and produce a videotape using persuasive communication skills.

Module Overview - Language Arts

The language arts portion of the "You Make It Happen" module involves students in the development of a video aimed at promoting energy efficiency. The steps involved in this process are designed to enhance student nonverbal and verbal communication skills, especially in the area of persuasion. Students will decide, as a class, on the format of their video. They will then write, direct, and produce the video. Opportunities to present the video to interested adult viewers are suggested.

Materials

camcorder and blank videotapes
videotape of commercials
How to Make Great Videos About Saving Energy videotape
Conducting An Energy Audit videotape
both tapes were produced by .....
available through your local Area Education Agency

Suggested Teaching Strategies

The paragraphs below contain suggestions as to how you might structure the video production process, including the presentation of introductory information and planning. You may wish to alter this approach to best fit your classroom situation.

For this first activity in this module, you will need a videotape of a variety of television commercials. You may wish to create this videotape yourself. Use approximately 15 recent and popular television commercials with appropriate content. Some weeks prior to beginning this module, ask students to tape some of their favorite commercials from their TVs at home. If just three or four students accepted this challenge, you would have enough taped commercials. Make certain that you preview student taped commercials before airing them in your classroom. Ten to twenty recorded commercials would provide excellent material for discussion in the first activity. If you are unable to get students to record commercials, simply record the commercials yourself, or ask your school's media department to make the recordings for you.

Begin the module by showing video tapes of recorded commercials. Ask the class to create a list of the commercial products advertised in the commercials. Then ask students to determine which commercials

they liked best and why.

Introduce persuasive techniques at this time. You may wish to include some or all of the following ideas:

Persuasive Techniques

1. *Authority:* A famous person or someone who has authority in our society pushes a particular product. Examples include commercials featuring a doctor or Michael Jordan.
2. *Side-tracking:* Discusses a subject that seems to be related, but is not. Examples include a basketball player trying to sell McDonald's hamburgers.
3. *Bandwagon:* "Everyone is doing it and you should too." This approach appeals to feelings of belonging. Example includes being a member of the Pepsi generation.
4. *Slanted language:* Uses words packed with emotion to make people feel a certain way. Examples of positive slanted language include use of words like smooth, fresh, and crystal clear. Negative slanted words might include bumpy, overdue, crowded, and noisy.

Show the video a second time, asking students to look for persuasive techniques used in each of the advertisements.

Inform students that they are going to create a video on the topic of energy efficiency. The video should be designed to persuade homeowners that they should use energy more efficiently. Emphasize that one or more of these techniques must be used in the class produced energy video.

Show the KID VID entitled "Conducting an Energy Audit" to the class. Discuss the persuasive techniques used in the video. This video will help give students a clear picture of what a finished product can look and sound like.

Since only one videotape will be developed for the entire class, it is important that students agree on the style or styles to be used for the program. Provide these suggestions, then allow students to decide, as a class, as to what approach their class video will take. Examples include a puppet show, talk show, radio show, game show, documentary, rock video, rap, sitcom, detective story, movie, mystery, circus, and newscast. Remind students that most of the above choices are programs on which "commercials" typically appear. Their production would likely have commercials as well. Ask students to think about which format will allow the greatest variety of interesting approaches to presenting persuasive information to homeowners. Make certain that students do not lose sight of their original purpose...their aim is to use persuasive techniques to convince their audience to adopt as many new energy efficient practices as possible! The most effective approach seems to be the development of separate vignettes developed by cooperative groups with a connecting thread. For example, one class filmed a family "channel surfing" to a variety of traditional television formats and parodies, each dealing with an energy topic.

Before students make the final determination of the style their video will take on, it may be advisable for students to break into smaller working groups and choose energy-saving topics for the video. Student groups may develop their own topics, or may choose from a list of available topics, including the following:

- low flow shower heads
- using fluorescent lighting
- cleaning furnace filters
- insulating the hot water heater and its pipes
- using the clothesline
- insulating electrical outlets

- efficient use of the dishwasher
- faucet aerators
- cleaning refrigerator coils
- closing up leaks in the fireplace
- closing up leaks in doors
- closing up leaks in windows
- using fewer lights
- turning down the water heater temperature
- taking showers instead of baths

The video should contain explanations of procedures involved in making specific changes. If time allows, students can research their selected topics. Creativity is encouraged, including the use of music, props, etc. Given the time constraints of this module, it would be advisable to have an assortment of reference materials on energy efficient practices available in the classroom. The following books offer background information for energy saving ideas. This information could be used by both the teacher and the students. These books are likely available through your local book store.
30 Simple Energy Things You Can Do to Save the Earth
50 Simple Things Kids Can Do to Save the Earth
50 Simple Things You Can Do to Save the Earth

One additional reference is the Guide to Energy Efficient Practices shown in Appendix A. The science teacher is likely to have multiple copies of this document which you might borrow.

Preview the video entitled "How to Make Great Videos About Energy" before showing it in class. The important steps in video production, as presented in the video, are summarized below. Show the tape to students reviewing the steps outlined in producing a video. A student worksheet/checklist is also included.

How to Make Great Videos About Saving Energy
Checklist of Tasks

1. What's your idea?
   Purpose: Why are you making this videotape?
   Audience: Who is your audience?
   Length: How long will your tape be?
   Style: What do you want your video to look like? (ex.: talk show, newscast, . . .)
2. Pick your topic.
   What topics have you chosen?
3. Construct a storyboard.
4. Assign all jobs.
   Costume design, Prop assembly, Make-up artist, Graphic artist, Location scout
   Lighting director, Camera person, Director, Actors, Others?
5. Rehearse
   How many times have you rehearsed?
   Have you had a dress rehearsal?
6. In-camera editing
   Point of view: Have you used an interesting perspective?
   Lighting: Did you use as much light as possible indoors? Did you avoid windows? Was the sun behind you outdoors?
   Audio: Did you eliminate all background noise?
   Camera Shots: Did you vary close-ups, medium, and wide shots?

Camera Movements: Did you keep the camera steady?

Each group develops a story board (as explained in the video) and explains their storyboard to the class. The whole class then decides how to put it all together using the ideas from the "how to" video and keeping consistent with the video style they decided upon. Students plan, rehearse, and film the video aimed at selling efficiency. At this point, a teacher may want to show the assessment instrument to the students so they will know the criteria by which they will be evaluated.

Home Connection:

Have several copies made of the student-produced videotape. Allow students to take the tapes home for family members to view. Route the videos to as many homes as possible. If a family has no access to a VCR, make arrangements for these students to show the video to an adult at school. This might include an administrator or teacher. Each student should have the adult complete the video questionnaire. (See Appendix C for sample letter home.)

Extensions:

- Have students present the video at a school board meeting or to community groups.
- Air the video on your school TV system or arrange to have it aired on local cable TV.
- Give a copy of the video to your local electric utility so they can make it available to the public.
- Exchange videos with other classes in your school, district, state, etc.
- Present a "live" energy program to an elementary class or a parent group using portions of the class script from your class production.

Alternative Approaches

- If the filming is beyond your school's resources, try hosting an Energy Awareness Night instead. Students could do their program "live" for parents and other interested parties, rather than filming the presentations.
- Students could prepare a series of commercials (radio, video, class presentation) aimed at energy efficiency. These commercials could then be shown at school events, or be sent home for parent viewing.
- Students could design and create newspaper advertisements designed to promote energy efficiency. Perhaps a local newspaper could be convinced to run some of the ads.
- Students could design, create, and distribute brochures, coloring books, comic strips, posters, etc. all aimed at promoting energy efficient practices in the home. The brochures could be distributed to parents and other interested homeowners.
- Students could conduct a poster and/or essay contest for the rest of the school. Arrange for a poster display at a local mall. Perhaps prizes could be solicited from the local utilities or other area businesses.

Suggested Evaluation Techniques

Criteria
1. The student will perform an active role in the video presentation.
2. The student will provide data to viewers that will persuade them that the suggested measure is easy to do and will save energy dollars.
3. The student will use correct techniques in the planning, writing, performing, and filming of the video.

Evaluation Tool/Authentic Assessment:
The student-made video is an authentic assessment for this unit in language arts. The following are suggested tools designed to evaluate student performance.
1. Rubric: You may wish to assign a point value to each column of the rubric to help determine each students' grade.
Unacceptable
Enough time spent off task to lower both the standard of your own work and to seriously interfere with the quality work time of others.
Individual make little or no effort to complete task.
Information presented about saving energy is incorrect or insufficient. The viewer was confused.
Presentation does not convince viewer to change.
Storyboard not used. Lack of attention to detail.
Filming/editing techniques were not effectively used.

Acceptable
On task most of the time, but some time lost to day-dreaming or off-task visiting. While not enough times lost to seriously affect work, could have provided more thorough and purposeful work related to the task.
Performed assigned task, but lacked some enthusiasm, conscientiousness.
Several important pieces of information present. Lacking sufficient detail.
While the need to increase efficiency is there, better persuasive techniques are warranted.
Storyboard used, but more attention to detail would have led to a greatly improved film.
Most filming/editing techniques correctly used, but could have been improved upon.

Excellent
On task all period. Purposeful work directed related to the tack. Valuable contributor to group production.
Performed assigned task with enthusiastic commitment.
Many good bits of information are presented clearly. Viewer can easily understand ideas. Good job of presenting details.
Need for increased efficiency is clear, employing good persuasive techniques.
Storyboard efficiently used with careful attention to detail.
Filming/editing techniques correctly used to create a visually stimulating persuasive video.

2. Evaluation form:
Group Criteria:
(5) 1. We have a clear, persuasive technique
(5) 2. Quality bits of information were presented
(5) 3. Solutions to ineffective energy use were presented
(5) 4. Viewers easily understood the ideas
(20) TOTAL

Individual Criteria:
(5) 1. I used good eye contact because I knew my lines
(5) 2. My voice was loud, clear, and expressive
(5) 3. My appearance supported my part
(5) 4. My actions helped express what I was saying
(20) TOTAL

3. Reflective Writing: Reflect on the energy efficiency video. Write a three paragraph paper with at least one paragraph to explain each of the following points:

a. Explain your role in the video presentation
b. Explain the persuasive techniques used in the video.
c. Explain the methods for increasing energy efficiency.

Final tips for developing realistic videotapes:
If students are videotaping, they need practice time using the camera.
It is best to start and stop the camera as little as possible.

Table of Contents Previous Section Next Section

SOCIAL STUDIES ACTIVITIES

Energy & Structures

Objectives

At the completion of this unit, student will demonstrate their knowledge of energy efficient architectural design by explaining the energy efficient features of past and present dwellings and by designing their own version of a home of the future.

Module Overview - Social Studies

Students will study the history of home design in Iowa from the 1840's to modern times. This look into structural design will take on an energy perspective in that students will constantly be asked to look at and to create designs that capitalize on energy efficiency, given the available resources of the time period being studied. As a culminating experience, students will be asked to design an energy efficient dwelling of the future.

Suggested Teaching Strategies

Prior to beginning this module in your class, it may be helpful to look in your school library for a small collection of referenced that may contain excerpts and/or pictures on log homes and homes of the 1900's. Students may want to refer to these periodically as they progress through the activities. Within each of the four activities comprising this module, suggestions are provided for conducting the lessons.

The Log Home in Iowa

Teacher Notes

Objectives:
1. Describe the log home in early Iowa and list the essential items contained in a log home.

2. Describe how heating and cooling was accomplished in the log home.

3. Explain the significance of locating the door on the south side of a cabin and of having trees located on the north and west side of a log home.

Materials:
Log Home Essentials - One set per student group (see Appendix D)
Scissors
Blank sheets of typing paper (1-2 per student group)

Larger sheets of white paper (roughly 25"x22")
Reference book for background information: ***"Life in a Log Home"*** available from the ***"Explorations in Iowa History Project"***, Price Laboratory School, UNI

Suggested Teaching Strategies:
In this investigation students compare and contrast the energy efficiency of a student-designed 1850 log home with information on actual structures of that era. Begin by giving each student a blank sheet of paper. Present the following information to the students.

Log Home Guidelines
a. The period of time is the 1850's.
b. You are an early settler in a section of rural Iowa, (Homesteading).
c. Available resources include:
* tillable soil
* nearby source of water
* large stones can be gathered from a nearby stream
* forested area nearby
* necessary tools of the time period (no saw mills)
* glass is not readily available
d. Using the available resources of the time period, design a dwelling for a family of four.

Have students work in pairs for this activity. Give each pair of students a copy of the "Log Home Essentials", found in Appendix D. The handouts contain drawings of the items typically found in log cabin homes of the 1800's. A sheet of typing paper can be used to represent the relative size of a log cabin home. Ask students to cut out each of the items shown on the handouts. Challenge students to arrange these items in the manner they think best, assuming the cabin is only one room and that all items must be arranged within the one-room cabin. Obviously, the trees and stream can be arranged around the outside of the paper. Each sheet contains a direction indicator. If questions arise as to it's purpose, simply ask students to place it near the cabin in the manner they think most appropriate. Be sure to stress to students that they are to come up with their "best guess" as to how a real log cabin was arranged. For now, they will only be setting the items on and around the sheet of paper, they will not be attaching them in place.

Prior to giving students any additional background information on early log homes in Iowa, allow students time to come up with an initial log cabin design of their own. This will give them a basis on which further discussion may be based.

After students have made their initial arrangements, discuss the student designed log dwellings. Ask students to defend the arrangements of items within and around the cabin. For example, where was the fireplace placed within the cabin? Ask students to give a rationale for the placement of the fireplace. Was there a particular reason behind the placement of doors and windows? How is their home heated? How is it cooled? Is there adequate allowance for light to enter during daytime hours? What reasoning was used in deciding upon the placement of each item within the cabin? Allow students to share their ideas with other members of the class.

Following this discussion, present information on the actual dwellings of the time. An excellent source of background information is ***"Life in a Log Home"*** available from the ***"Explorations in Iowa History Project"***, Price Laboratory School, UNI. This work is a short (12 page) narrative by Onieta Fisher, a dedicated historian and imaginative poet. This article presents a vivid portrait of the Iowa pioneer home from the details of its physical structure to the mode of living common to its crowded dwellers. Read excerpts from this to students. Ideas from this reading may inspire students in their redesign plans for

their log homes.

Challenge students to modify their design based upon the new information presented. What changes would they make in their dwelling to get the most energy efficient design? (This could be started in class and completed as homework). Once students are satisfied with their revised arrangement, choose one or two typical cabins to display as models. Ask students to glue down the items and perhaps add some color. Display the pictures in the classroom. The remainder of the student's models will be rearranged as part of activity 2, and thus, should not be glued into place.

Background:
Early pioneer cabins usually had one room with an overhead loft where the children could sleep during warm weather. The loft was reached by a ladder. Most cabins were relatively small, perhaps 10 by 12 feet, although some were larger. Focus on the idea that there was no air conditioning and only one source of heat, the fireplace. The door was typically "to the south" to let light in and to mark the passage of time as the sun moved a shadow farther and farther along the floor. The doorways were made from skins or puncheon slabs. Windows were covered with paper to let light in. The paper was waxed with grease or animal fat to give it a coating for protection against rain and snow.

Pioneer furniture was simple. There were no rugs or curtains. Most furniture was homemade. During winter months, children slept on straw mats next to the fireplace. The spinning wheel held a prominent position in the pioneer home in Iowa. Spinning, weaving, and dying cloth for the necessary clothing kept women and children busy for many hours. Wool and flax (a plant) were also raised for cloth. The lighting was very crude. Most families made their own candles.

The hearth was a very important part of each cabin. It was generally made of flat limestone rocks, found lying along streams. The fire was kept burning day and night. The hearth fire cooked the pioneer meals, consisting of meat, corn meal, salt pork, vegetables, fruits (if in season) and coffee. Wild game was also eaten if the father was a good shot. The fireplace was the central feature of the cabin, providing heat, light, and a place for cooking.

Pioneer cabins were crowded. Most families had 3-4 children and everyone lived in one or two rooms. Not much space was available for furniture. Homes needed to be energy efficient since there was no air conditioning and the only source of heat was from wood. A well-constructed log home would have been relatively comfortable, with its thick walls and its close-to-earth design, although much of the heat from the fireplace escaped up the chimney on windy days.

Most cabins were made of logs, notched at the corners and laid one upon another. The roofs were clapboards with the shingles held down by weights. Floors were heavy wooden slabs or split logs with the smooth sides up and were called puncheon floors. The cracks were filled with dirt. Where timber was scarce, cabins were made from sod.

Extensions:

- Ask students to construct a model of their log home. Set up a display area where student-made structures can be viewed by students and faculty in your school. This could even be made into a contest in which the viewer is challenged to identify the most energy efficient home of that time period.
- Some students may be interested in conducting further research into the tools and architectural designs of log dwellings of the 1800's.
- Challenge students to create a window of the 1800's. One type of glass window can be made by chinking jars together. This can be accomplished by packing a mixture of clay, straw and grass in

open gaps between glass jars. A greased paper window can be simulated by rubbing vegetable oil on various types of paper. Students can then compare the amount of light penetration for the chinked as well as paper windows. (This would make an interesting school display as well.)

Homes of the Early 1900's

Teacher Notes

Objectives:
Similar to that of the Log Home Activity

Materials:
Essentials of the 1900's Iowa Home - One set per student group (see Appendix D)
Scissors
Glue
Blank sheets of typing paper (1-2 per student group)
Larger sheets of white paper (roughly 25"x22")

Suggested Teaching Strategies:
In this investigation students will explore the evolution of architectural design from mid 1800's to the early 1900's by modifying their 1850 log dwelling to match the new developments and resources of the time.

In many instances, rather than simply building a new house, additions were made to the original log cabin. Discuss the changes in architectural design and home conveniences that have taken place since the 1850's. For example, in Iowa:
1. stoves have taken the place of the fireplace
2. milled lumber is available
3. porches and summer kitchens are common place
4. two story construction is available
5. there is greater availability of glass and hardware
6. landscaping has become more important (location of windbreaks and shade trees)
7. wells and windmills make water more accessible

Give each student group a scissors and a copy of the handout entitled *"Essentials of the 1900's Iowa Home"*. Following a discussion of the changes listed above, challenge students to modify their log home design to fit the 1900's time period. Students must keep their original log cabin room. They may move items into the new rooms and they may divide the original room into smaller rooms. The original 81/2" x 11" sheet of paper as well as the items present in the log cabin, with the exception of the fireplace, should be used in the design for this activity. Additional rooms, including a porch, kitchen/pantry and upstairs, are provided in the handouts. The size of the cutouts should provide a good indication of the actual relative size of the new additions.

Ask students to share their completed designs with the class. Have students glue their pieces into place once they are satisfied with their arrangement.

Extensions:

- Challenge students to make their paper model three dimensional, representing the second floor elevated above the main floor.
- Interview an adult about the types of dwellings in which they lived during their youth. Ask students to compare these ideas to their own 1900's home design. Grandparents, retirement home residents, and other senior citizens would make excellent interviewees.
- Videotape or photograph dwellings built in the early 1900's. Prepare a bulletin board display of these dwellings. Photographs can likely be obtained from your library or the local historical society.

Energy and Structures at Home

Teacher Notes

Objectives:
1. Explain how the location of windows can effect efficient heating and cooling of a home.

2. Describe how landscaping can affect a homes energy efficiency.

Materials:
student page (one copy per student)
rulers or other straight edge
blank typing paper

Suggested Teaching Strategies:
In this investigation students will gather information from their own homes regarding architectural design and energy efficiency. Give each student a copy of the Energy and Structures Home Survey. Students should be able to complete this assignment during class, although it requires they recall the location of all windows in their home.

Encourage students to share the positives and negatives of the structural and design features found upon competing this assignment. Discuss student answers to the "Summing Up" questions. Be sure to ask students to explain the reasoning behind their answers. Discussion should include home features found that had been present in homes discussed in Activities #1 and #2.

Extensions:

- Write a letter to your parents explaining the relationship between location of windows and energy efficiency.
- Draw up a landscaping plan for your home designed to increase energy efficiency.

Energy & Structures Home Survey

Student Page

In the United States (except Alaska north of the Arctic Circle), the sun is always in the southern half of the sky. This means that windows that face north never let in direct sunlight. In cold weather, north-facing windows are heat-losers. As the prevailing winds tend to be from the northwest in Iowa, much

heat can also be lost during windy and cold Iowa winter months from windows on the north and west sides of a house. Any landscaping that can serve as a windbreak for these northwesterly winds will help to have heating energy. Windows facing south can let in direct sunlight and can help heat your home, especially if you cover them with insulation at night.

Let's Investigate:
Make a sketch of your home. Label which sides of your home face north, south, east and west. Make a separate sketch for each story (floor) of your home. Count the number of windows on each side of your home. If your windows are different sizes, approximate the size of the larger windows in your drawing. Estimate how many smaller windows it would take to equal the size of your large windows. Be sure to count glass patio and other sliding doors as well. On your drawing, label each side of your house/apartment with the correct number of windows.

During summer months, energy can be saved by shading any windows that let in direct sunlight. What kind of shade (natural or built-in) do your south-facing windows have? Indicate on your drawing where you have awnings, building overhangs, trees or vines which provide shade, or any other shading devices.

During winter months, strong prevailing winds can accentuate heating problems caused by poorly sealed and insulated areas in your home. This means that in Iowa's climate, the north and west sides of the house are considered the "windy" sides of your home. Heating dollars can be saved by using appropriate landscaping. This might include a windbreak consisting of bushes or evergreens. It is also advantageous to have fewer windows on the northwest side of a home. Add to your drawing a sketch of any natural windbreaks present around your home.

Summing Up:
1. Do you think the locations of windows in your home have been well-planned to take advantage of heat from sunlight?

2. Is your home in need of any additional shading? If so, where? Explain your answer.

3. Are the north and west sides of your home designed to save energy during winter months? Explain your answer.

4. Imagine you have a friend whose family is building a new home. Write four suggestions you would give your friend to help ensure the new home has energy efficient design features.

Designing Your Home of the Future

Teacher Notes

Objectives:
Students will be able to incorporate energy efficient window placement and landscaping into the design of a "modern" home.

Materials:
drawing paper
straight edge

Suggested Teaching Strategies:
In this investigation students will design and draw a dwelling of the future, applying the knowledge they have gained about energy efficiency and structures. Challenge students to design and draw a family dwelling of the future. In preparing their designs, students must adhere to the following building codes:

- No windows are allowed on the north side of the house.
- Any computerized systems for lighting, heating, cooling, cooking, etc. must be described in the "special features" section.
- Structure must have space for temporary storage of recyclables (paper, cardboard, plastic, glass, metals and compost).
- Proper landscaping must ensure adequate shade for cooling purposes in the summer and shelter from the prevailing northwest wind during winter months.
- Any solar cells or solar panels must be located on the south side of the house.

Students should apply what they have learned about architecture and landscaping design. Ask students to prepare a short presentation for the class in which they will share their futuistic home design, discuss its special features, and point out its energy efficiencies.

Extensions:

- Design a dwelling for a variety of environments; (rain forest, desert, Arctic, marine, outer space, etc.)
- Ask students to research dwellings of other cultures and locations. Prepare a bulletin board display of structures and their energy efficient features.
- Challenge students to build a model of their dwelling.

Table of Contents Previous Section Next Section

APPENDICES

Appendix A

Science

Plans for Converting Electrical Meters

Your local utilities should have old electric meters available. Some utilities may be willing to donate the old meters to you if you explain that it is for classroom use. The utilities may even offer to mount and wire the meters for you. It would be best to have five to six meters for your classroom. However, two would be sufficient if you had students do the activities in "shifts".

The directions below will allow you to "wire" the meters for classroom use. Purchase the following materials: Approximate costs are indicated after some material.

Wire strippers
wire crimpers
hacksaw
screwdriver
magic marker
electrical tape
ring terminals
covered wire
electrical tape
1" x 8" x 12" pine board (1 per meter) $0.50
1" x 8" x 9" pine board (1 per meter) $0.40
2" x 2" x 71/2" #2 pine board (1 per meter) $0.25
Wood Glue
#6 finish nails (8 per meter) $0.10
#12 3/4" wood screw (1 per meter) $0.05
#6 3/4" wood screw (2 per meter) $0.05
#14 - 3 wire electric cord (6 feet per meter) $2.40
Door pull (1 per meter) $1.00
electrical extension cord (approximately 1 meter long) Must be able to accept 3-prong cords. Should be

at least 13 Amp, 125 volt, 1625 watt rating. $5.99
A-Base 120 volt electric meter free to $15.00 (contact local power company)

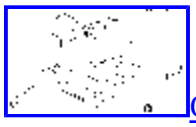
Assembly Directions:

 Click here to get the diagram of the meter

1. Using a magic marker, mark the "hot" side of the extension cord about 10 inches from the outlet end. To locate the "hot" side, simply note which side of the plug-in end of the cord has the narrow metal strip.
2. Cut the extension cord near the place you marked. Make sure you know the "hot" side of each piece--you may want to mark both pieces. Using a wire stripper, strip the ends of all wires.
3. Using a standard screwdriver, lift up the plate on the "wired" part of the meter. Loosen the four large screws, the two small screws on the upper right (take off and discard the brass pieces), and the small screw on the right on the bottom of the meter.
4. Cut a notch in the plastic, using a hacksaw, on the lower right-hand side of the front to allow room for a cord to lie when the front plate is put back.
5. Expose the middle ground wire (green) by pulling down the hot side of each piece of cord about 4 inches. Make sure that the ends are stripped about 1/4 to 1/2 inch. Twist together the two ends of the ground wire and insert into a ring terminal. Crimp the plastic terminal to secure the ends of the wire.
6. Place the stripped ends of the "cold" side of the cords into a ring terminal and crimp.
7. Twist the exposed wire of the "hot" side of the plug-in end and insert it into the farthest left box. Hold it in there and tighten the screw so that it is squarely on top of the wire and holding it tight. Do the same with "hot" wire of the outlet side, and put it in the next box over. Tighten that screw.
8. Cut a short piece of wire to connect the two right hand boxes, forming a U-shape. Strip the wire ends, twist, and tighten the screws as before.
9. Take the green ground wires and the screw that was on the right-hand side of the bottom. Put the screw in the hole of the ring terminal, and screw it back into its original space. Make sure it's tight.
10. Take the final small screw that you loosened and put it through the ring terminal of the "cold" wires. Screw back into place and tighten. The "cold" wires should lay in the place you notched out.
11. Turn the meter over. You will see a place for the meter to "hang" on a screw and two smaller holes for additional attachment. Lay the meter on the 1" x 8" x 9" board, about 3/4" from the top. Mark on the board where the top of the meter is. Screw the larger screw into the board about 1/4" to 3/8" below this mark, leaving 1/4" exposed to be able to hang the meter.
12. Hang the meter on the board and lay the board and lay the board on your work surface. Drop a pencil into the two holes near the bottom to mark the center of these holes. Remove the meter and start screw holes at these marks.
13. Now attach that board to the 2" x 2" x 7 1/2" board with several nails. The 2" x 2" should be attached at the back so that its bottom and the bottom of the 1" x 8" x 9" board are flush.
14. Attach the door pull on the back of the 8" x 9" board about 1 inch down from the top.
15. Turn the board over again and hang the meter on the large screw. Drop a screw into one of the holes so that its point is in the hole that you started in the board. Screw in tight and repeat with the other screw. Replace the plate on the meter--it may require some hammering to secure it.
16. Follow the directions on the wood glue and attach the 2" x 2" and 8" x 9" boards to the 1" x 8" x 12" board. The 2" x 2" should be flush with one 8" side

of the big board. The meter should be facing over the board. When the glue is dry, nail the 2" x 2" into the bigger board.

17. Attach the outlet end of the cord to the large board with electrical tape. Your meter is ready to use! Just plug it into an electrical outlet and plug an appliance into the cord outlet and read the meter.

 Click here to get the diagram of the meter mounting assemby

Average Rating of Common Household Appliances

Cooking & Food Preparation
Range (standard) ... 12,500 Watts
Dishwasher ... 1300 W
Microwave ... 1450 W
Broiler ... 1400 W
Coffee Maker ... 900 W
Garbage Disposal ... 450 W
Toaster ... 1150 W
Blender ... 390 W
Electric Mixer ... 100 W
Can Opener ... 175 W
Lighting
Table Lamp (3-way inc. bulb) ... 100 W
Ceiling fixture (5-bulbs) ... 300 W
Fluorescent bulb ... 15 W
Home Entertainment
Radio (solid state) ... 5 W
Television (color) ... 330 W
Stereo .. 30 W
Comfort & Health
Room Air Conditioner (6000BTU/hr) ... 935 W
Room Air Conditioner (9000BTU/hr) ... 1400 W
Fan (portable) ... 115 W
Hair Dryer ... 1250 W
Heating Pad .. 65 W
Electric Toothbrush ... 10 W
Electric Blanket ... 180 W
Clothes Dryer ... 4800 W
Water Heater ... 4500 W
Freezer (frost-free) ... 425 W
Refrigerator-freezer ... 500 W
Miscellaneous
Clock ... 2 W
Electric Lawn Mower ... 1500 W
Sewing Machine ... 75 W
Vacuum Cleaner ... 800 W

Sample Letter Home

Dear Parent/Guardian:
Over the next two weeks your son/daughter will be completing an in-depth unit on energy use and efficiency in the home. Students will be collecting data on their home's lighting, appliances, air leaks, and other energy use practices. Throughout this unit, students will be compiling data and developing written summaries of suggestions for improvement in your energy use. It is important that students gain

experience in making verbal presentations as well. We would like your son/daughter to schedule a short presentation with you to discuss their findings. The presentation should occur during the days of November ####, 199#. Not only would we like you to listen to the presentation, we also request that you evaluate their presentation and the accompanying written material. In doing so, please use the following format:

1. Students will speak for a time of approximately five minutes. They should discuss their findings, including mention of those energy efficient practices you are currently using.

2. Following the presentation, the listeners may ask questions.

3. Complete the evaluation sheet at the end of the session.

4. Place the evaluation sheet in an envelope, seal, sign across the seal, and return it to school with your son/daughter.

Thank you for your cooperation in this project. The students are quite excited about the possibility of actually influencing their parents energy behaviors.

Sincerely,
Teacher's name
Class

Home Energy Inventory - Student Presentation

Evaluation Sheet

Parent/Guardian Evaluators:
Student:

1. Knowledge of subject: (up to 5 points each)
____Appliances
____ Lighting
____ Energy Waste
____ Air Leaks

2. ____ Organization of information in writing and throughout the presentation (up to 5 points)

3. ____ Clarity, ease with subject, enthusiasm throughout presentation (up to 5 points)

4. ____ Informative nature of written letters and summary reports (up to 5 points)

_____ TOTAL

Comments:

Do you view the home energy inventory as.....
beneficial?
just OK
a waste of time

Thank you for your participation in this project!

Home Appliance Survey

Answer the following questions by either asking your parent/guardian or by examining the appliance. In cases where your home does not have the appliance in question, simply skip that section. Be sure to record all of your data in a logical fashion.

REFRIGERATOR
ASK
1. When was the last time the coils on your refrigerator were cleaned to remove dust from the coils and vents?

LOOK
1. Are the foods in the refrigerator capped or covered?
2. At what temperature is your refrigerator set?
3. At what temperature is your freezer set?
4. If you do not have a frost free refrigerator, what is the approximate thickness of frost build up in your freezer?
5. Close the refrigerator door on a crisp dollar bill. Is it held tightly in place or does it slip out easily?
6. Is your freezer full, less than half full, or more than half full?
7. Is the refrigerator placed away from heat sources such as range, oven, heat registers, and direct sunlight?

WASHING MACHINE/DRYER
ASK
1. What percentage of your washing is done using cold water? Is hot water ever used?
2. How often are your clothes dried outdoors?
3. When was the last time the lint was cleaned from the motor, drum, and pipes of the dryer?

LOOK
1. Check the drier for lint. Is the lint filter clean?
2. On what water temperature setting is your washer currently set?

WATER HEATER
ASK
1. When was the last time a bucket of water was drained out of your water heater to flush out accumulated sediment?

LOOK
1. Is there any insulation on the hot and cold water pipes going in and out of the water heater.
2. Is there an insulating blanket on your water heater?
3. At what temperature is your water heater set?

DISHWASHER
ASK
1. Do you use the drying cycle on your dishwasher?
2. Do you wash only full loads in the dishwasher?
3. Do you wash dishes by hand? If so, how often?
4. Is there a certain time of day at which you typically use the dishwasher? If so, what time?

LOOK
1. How many different settings does your dishwasher have? On which setting is your dishwasher currently set?

FURNACE/AIR CONDITIONER
ASK
1. How often is the furnace air filter cleaned or replaced?
2. At what temperature is your air conditioner typically set during summer months?
3. At what temperature is your furnace typically set during winter months?
4. Do you adjust the thermostat at different settings for daytime than for nights?
5. Is your furnace checked annually by a professional?

LOOK
1. Locate the air conditioner compressor unit or window air conditioner outside your home. Is the unit located in a shady area? Are any structures or bushes touching the sides of the unit?
2. Do you have a programmable thermostat?

Energy Efficiency Survey

Water/Hot Water Heater
How many of your family members usually take showers instead of baths?
When preparing a warm bath, do your family members close the drain before starting the faucet?
Are clothes washed and rinsed in cold water?
Are there any leaky faucets in your home?
How many people in your home turn off the water while brushing their teeth? How many do not?
Are there aerators on any of your faucets? If so, how many?

Heating/Cooling
Do you turn off the air conditioner if you're leaving the home for more than one hour?
Are any of your registers blocked with furniture? If so, how many?
At what temperature does your family typically set the air conditioner?
At what temperature does your family typically set the furnace during winter months?
Does your family readjust the temperature settings on your air conditioner and furnace during sleeping hours?

Air Infiltration/Insulation
Are bathroom and kitchen vents frequently left turned on even when moisture and odors are not a problem?
Are your storm windows closed when the furnace or air conditioning are in use?
Are your storm doors always kept closed when the furnace or air conditioning are in use?

Lighting\Use of Other Appliances
Are lights always turned off when not in use?
Is the television frequently left turned on even when no one is watching?
Does your family use small appliances for tasks that could be easily done "by hand"? If so, name the appliances.
Does your family ever let dishes "air dry" in the dishwasher?
Does you family ever hang clothes on the clothesline rather than using the dryer? If so, how often?
When putting away groceries, do members of your household open and close the refrigerator door frequently or are all items placed in the refrigerator quickly and at the same time?

Ask 2-3 different people in your household to answer the two questions posed below. (You may include yourself)
1. Name 3 good energy use behaviors in which you typically engage in your home.

2. Name 3 energy use behaviors you typically engage in which are not good energy use practices?

Guide to Energy Efficient Practices (EEP)

AIR INFILTRATION

- Close doors and registers to unused rooms.
- Make certain doors and windows are caulked and weather stripped. About 15% of air leakage is through windows and doors. Caulking on the outside is mainly for keeping rain out of the walls and doesn't significantly slow air leakage; caulk on the inside.
- Are there storm doors and storm windows?
- Are their air leaks in and around the fireplace? Consider installing tight fitting glass doors to control air flow. If you are not planning on using the fireplace, think about putting in a flue plug.
- You can lose heat through your electrical outlets and switches. Most leakage occurs on outside walls, but even in inside walls, pressure differences may draw air from the room through the outlet and up the partition to the attic space. Consider installing foam gaskets around electrical outlets and switches.
- Weather-strip attic access doors.
- Seal around the chimney using a high temperature sealant.
- Insulate the attic to R-40.
- Replace broken glass and loose putty on window glazing.
- Seal around all ceiling fixtures, heat registers, medicine cabinets, bath tub, kitchen cabinets, drain and water pipes.
- Install plastic over inside of windows during winter months.
- Caulk along baseboard with a clear sealant.
- Replace your old entry door with an insulated door.
- Install tight fitting glass doors over fireplace.
- Insulate the band joists in the basement foundation walls.
- If you have a crawl space, place a layer of plastic on the dirt floor, close any vents, and insulate the walls.
- Caulk around all exterior penetrations such as gas, electrical, telephone, cable, dryer vents, water faucets, etc.
- Install a storm door where you have none.
- Use bath and kitchen vents sparingly when moisture and odors are not a problem.
- Lock your windows so they will seal tighter.
- Try to use doors that are protected from the wind.
- Be sure thermostat is located away from heat sources and cold drafts.
- Close drapes at night and on cloudy days.
- Insulate or remove window air conditioners when not in use.
- Close fireplace damper tightly when not in use.

APPLIANCES
Refrigerator

- Clean coils and vacuum dust from refrigerator vents at least once a month.
- Cut down the number of times you open the refrigerator door. Decide what you need before you open the refrigerator. Take out everything you need for a meal, all at once, and quickly.

- If your refrigerator or freezer will not be used for a long time, clean it, unplug it, and leave the door open.
- Liquids in the refrigerator should be capped or covered or they will add humidity and make the refrigerator work harder.
- Defrost the freezer when there's more than 1/4 inch frost built up.
- Set your refrigerator between 38 and 40 degrees F and the freezer at 32 deg F. Keep freezer filled, but not packed. It is uneconomical to operate an empty or half-filled freezer.
- Check your refrigerator seal by closing the door on a $1 bill. If it is held tightly in place, the seal's OK; if not, the door should be adjusted or the seal replaced.
- The larger the capacity of the refrigerator, the more it costs to keep the food cold.
- Don't buy a larger freezer than your family needs.
- Avoid placing warm dishes in your refrigerator or freezer. If possible, wait until they are cooled to room temperature.
- Liquids in refrigerators should be capped/covered or will add humidity and make refrigerator work harder.
- Thaw frozen foods in the refrigerator overnight.
- Place the refrigerator away from heat sources such as range, oven, heat registers, and direct sunlight.

Washing Machine/Dryer

- Use a cold water laundry detergent and always rinse in cold water.
- One quarter of your hot water is typically used for washing clothes. Wash clothes in warm or cold water and always rinse in cold; washing in hot water doesn't get clothes any cleaner.
- Select a dryer with a moisture sensor that will shut off when the clothes are dry.
- Dry clothes outside whenever possible.
- Doing only full loads of wash saves hot water and electricity.
- Check the drier for lint . A clogged filter keeps air from circulating, and that means the dryer has to run longer to dry a load. Lint filters should be cleaned after every load and the lint vacuumed from the motor, drum and pipes at least once a year.
- Warming up the clothes dryer takes energy. Save energy by drying loads one right after another, without giving the dryer a chance to cool off.
- Over-drying will wrinkle and damage fabrics and wastes energy.

Water Heater

- Drain a bucket of water out of your water heater at least once a year or more often if you have hard water to flush out sediment that can accumulate.
- Insulate the first 10 feet of hot and cold water pipes out of the water heater.
- Cut hot water bills by insulating pipes to and from the hot water heater.
- Insulate water heater and hot water pipes.
- Adjust your hot water heater temperature. It should be set at 130 deg F or lower. At these temperatures you avoid bad scalds and save energy.
- Install a passive or active solar water heating system.

Dishwasher

- Scrape the dishes before placing them in the dishwasher so you can use the shortest cycle possible to clean the dishes.
- Don't use the rinse and hold cycle on the dishwasher.
- Run only full loads.

- When there are just a few dishes to wash, do them by hand, not in the dishwasher. However, one dishwasher load uses less hot water than three washings by hand.
- Open the door and allow the dishes to dry naturally instead of using the drying cycle.
- In the summer, use the dishwasher early in the morning or late in the evening when it's cooler outside.

Furnace/Air Conditioner

- Replace or clean the furnace air filter at least 3-4 times/ year.
- Set air conditioning temperatures as high as possible. Raising the temperature setting by 6 deg F, for example from 67 to 73 deg F, during warm weather could save 12%-40% of the cooling costs.
- Shade the outside air conditioner compressor unit, but do not block the air circulation.
- Have your furnace checked annually by a professional. A tune-up can lower fuel costs as much as 10%.
- Half or more of the money you spend on energy for your home goes into heating. That makes the furnace the most important appliance in the house. Replace your old thermostat with a new "set-back" or programmable thermostat. You'll shave up to 5% off your heating expenses for every degree you reduce your home over a 24-hour period. So turn down your thermostat (but not below 57 deg F). With air conditioning, it's just the opposite. You save by turning your thermostat up. Don't go below 75 deg F. Do occupants adjust thermostat at night and when not at home?
- In cold weather, cover windows by pulling the drapes at night. In hot weather, open windows to let in cool night air.

Oven/Microwave

- Lower the oven temperature by 25 degrees when baking with glass or ceramic dishes.
- Most foods don't need a preheated oven. The general rule is this: any food requiring more than one full hour of cooking time may be placed in a cold oven.
- Avoid peeking, the oven temperature lowers by 25 degrees each time you open the door.
- Use microwave oven instead of range to warm food.
- Whenever possible, use your microwave, toaster oven, or slow cooker instead of your electric range.
- Turn the oven off a few minutes early and use retained heat to finish cooking.
- Instead of heating water in an open pan, use a teakettle.
- The oven is a very inefficient toaster. It costs three times as much to toast bread in the oven as in a pop-up toaster.
- Don't use your electric stove to boil water; an electric kettle uses half the energy.
- An electric frying pan uses less energy than a regular frying pan on an electric burner. But if you do not use the appliance often, the energy used to manufacture it is wasted.

Lighting

- Fluorescent lights are more efficient than incandescent lights. A 40 watt fluorescent light bulb will produce the same amount of light as a 150 watt incandescent light bulb. It is not practical to replace every incandescent bulb with fluorescent bulbs. Choose those locations where lights are left on for relatively long periods of time (3 or more hours per day).
- Turn off fluorescent lights if leaving the room for more than 10 minutes.
- Turn off incandescent lights if leaving the room at all.
- Turn off all unused lights.
- Keep outdoor illumination to an absolute minimum.
- Keep bulbs & fixtures clean. Accumulation of dust can lower lighting level.

- Avoid inefficient "long-life" light bulbs. While they do last longer than regular incandescent bulbs, they use more energy.
- Use low wattage light bulbs whenever possible.
- Do not use compact fluorescents with dimmer switches.
- Replace incandescent light bulbs with fluorescent bulbs where possible. Although they cost more, fluorescents last 15-20 times longer than incandescents. A 60 watt fluorescent light bulb gives you as much light as a 180 watt incandescent bulb at 1/3 the cost.
- Let the sunshine in! During winter days or days when the air conditioning needs will not be increased, open your draperies and leave your lights off.
- Place floor lamps in a corner instead of along a wall; they'll reflect light off of two walls, giving you more usable light for your money.
- Try 50 watt reflector floodlights in direction lamps.
- Where possible use one higher wattage bulb instead of several lower wattage bulbs. A 100 watt bulb gives 20% more light than two 60 watt bulbs.
- When redecorating, use lighter colors to reflect more light. Paint walls white or a light color. White reflects light and increases the total amount of light in a room.

Energy Waste

- Take quick showers instead of baths whenever possible.
- Use fans instead of an air conditioner.
- Use cold water to operate food disposal.
- Turn off the air conditioner if you're leaving the home for more than an hour.
- Dress for indoor winter warmth so you avoid turning the heat up too high.
- Dress coolly in summer so you avoid turning the air conditioner too low.
- When preparing a warm bath, close the drain before starting the faucet. The first gallon or two will be the only cold ones.
- Bathe with less water in the tub.
- Use a combined spray tap-aerator on your kitchen sink faucet.
- Insulate the floor over any unheated spaces like crawl spaces, basements and garages.
- Use awnings to keep the sun out of south-facing windows in the summer, then take them down for solar heating in the winter.
- Don't run water unnecessarily.
- Insulate basement walls.
- Keep water beds covered during the day. Insulate around waterbed mattress.
- Use cold water when it will do as well.
- Repair faucet leaks: A hot water faucet that drips one drop each second can waste as much as 2,100 gallons of hot water each year.
- Keep drapes closed at night.
- Turn off the water when brushing teeth.
- Lower the thermostat to 68 deg F; 60 deg F at night during the heating season.
- Install low-flow shower head and faucet aerators. With a low flow shower head, you can cut the amount of hot water you go through by 1/3 to 1/2.
- Don't block registers with furniture.
- Close registers and doors to unused rooms.
- Turn off unnecessary lights and appliances.
- Use bath and kitchen vents sparingly when moisture and odors are not a problem.
- Wash only full loads of dishes or clothes.
- Install a ceiling fan to create air movement in the summer, avoiding the use of air conditioners.
- Check your EnergyGuide labels when shopping for appliances; the lower the kw/hour number shown, the more energy-efficient it will be.

Appendix B

Mathematics

SAMPLE LETTER HOME
Date:
Dear Parent/Guardian,

Your son/daughter is participating in an energy unit in math, science, social studies and language arts. Part of the unit entails studying local utility bills, learning how to explain variability over time. While we have sample data for an average family available, it would be more meaningful for students to work with data from their own homes. If possible, would you aid your son/daughter in locating on your utility bills, the information indicated below:

Month:
Electricity (KWH):
Gas Units (therms or mcf):

Please note if gas or electric:
Heating:
Water Heater:
Stove/range:
Clothes dryer:

Number of persons living in your home:

Thank you for your cooperation on this project.

Sincerely,
7th or 8th grade team

Appendix C

Language Arts

Sample Letter Home

Date:
To: Parent/Guardian of ### grade students
FROM: Name of teacher & class

We have just completed an exciting visual experience in our language arts class. We would like you to take the opportunity to view and enjoy this tape, written and produced totally by students. Please view the accompanying SHORT video with your student. After viewing, complete the following questionnaire, sign, and have your student return the tape and questionnaire to school. Thank you for

your cooperation!

Video Questionnaire
1. What was the most important information about energy saving that you gained from this video?

2. Based on the information presented in the video, what could you do to help save energy in your home?

3. What did you like best about the video?

Additional Comments:

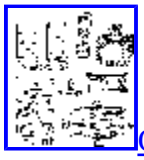
I have viewed the video with my student and gave input to the questionnaire.

Signature(s):
Date:

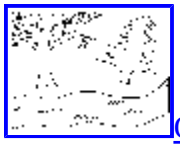
Appendix D

Social Studies

LOG HOME ESSENTIALS

 Click here to get the first set of images

 Click here to get the second set of images

 Click here to get the third set of images

ESSENTIALS OF THE 1900's IOWA HOME

 Click here to get the first set of images

 Click here to the get second set of images

 Click here to get the third set of images

 Click here to get the fourth set of images

---

Table of Contents Previous Section