WATT WATCHERS
4-H ENERGY PROJECT

Understanding Energy Usage

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Objectives

In this project you will learn

- how energy is used and why it is important;
- about renewable energy sources and why they are important;
- about nonrenewable energy sources and why they must be conserved;
- why energy consumption has increased substantially over the years; and
- to read your home electric meter and to compare kilowatt-hour usage with family activities.

Project Requirements

To complete this project you will

- compare the amount of energy you use to the amount used by your parents and grandparents when they were your age;
- take an imaginary trip to a land that has no fossil fuels to see what life would be like;
- read your electric meter and teach another family member to read it; and
- encourage your family to make a plan to conserve electricity and assist in carrying out the plan.

Key Words

The key symbol indicates a key word and its definition. It's important that you learn to use these words as you learn about energy. After you have completed this project, you are encouraged to take other projects in this series to learn more about energy conservation.

Prepared by Mary N. Harrison | Professor | Extension Specialist in Consumer Education
What is Energy?

There is a lot of talk about energy . . . but just what is it? Simply stated, energy is the ability to do work. There are many kinds of energy.

For example:

Quite early, man looked for other sources to do his work for him. He learned to use animal energy.

You use energy from the sun for heat and light.

You use human energy when you walk or run. When tired, do you sometimes say, "I'm out of energy?"

Energy

The capacity for doing work.

People also found other energy sources in nature. The energy of moving water was used to float a canoe and to turn water wheels.

The energy of the wind was used to turn windmills and to move sailboats.

Through combustion (burning), the energy stored in fuels such as wood and coal was changed to other energy forms — heat and light.
The mechanical energy of machines is work, for example, cars, ships, and manufactured products.

Electrical energy operates machinery, provides lights and sound.

Light energy operates solar equipment, scanners, and lasers.

The world in which you live today is much different from the world of earlier years. The world of today uses much more energy than was used in the past. It also offers a higher standard of living — better homes with many conveniences such as electric lights, instant hot water, heat in winter, and cool air in summer. You also have better transportation and a more abundant food supply.

**Lifestyle**

The way a person lives as shown by actions, attitudes, and possessions.

Chemical energy provides batteries, energy from food.

Nuclear energy generates electricity, enables medical treatment by radiation.

Examples of sound energy are sonic booms, radio, and tapes.
Types of Energy

Some sources of energy cannot be used up or destroyed. These nonexpendable sources include wind, moving water, and the sun. Some energy sources are found in nature, and these sources are known as natural forms of energy. Energy from the sun is known as radiant energy because the heat from the sun travels by radiation. This is similar to the way that heat travels from a fire or from the heating unit in an oven.

List three ways natural energy is used for work.
1. ________________________________
2. ________________________________
3. ________________________________

Where in your home can you find radiant energy helping you do your work? Look around to see where you can find energy (heat) transferred by radiation.

List three ways radiant heat is used in your home.
1. ________________________________
2. ________________________________
3. ________________________________

There are other commonly used energy sources besides the sun, wind, and moving water. These other sources are grouped into two general classes, renewable and nonrenewable.

Some energy sources can be used up, but they can be reproduced in the same form. For example, energy can be produced from plants and trees and by humans and animals. If we burn wood from trees, other trees can be grown to replace them. Humans and animals can do physical work. When they are tired, they can eat and rest; then they are able to work again. Plants and animals were the primary energy sources first used by man, yet most of these sources are not developed highly enough to produce the great amounts of concentrated energy needed for our industrial world. Although a considerable amount of energy can be produced from burning wood, it takes many trees which require much space and it takes a long time to grow them. The energy from wood and other such materials is not concentrated and thus it is not an adequate energy source for today's lifestyles.

Natural Energy Source
Energy that can't be used up. It keeps reoccurring, for example, a waterfall.

Radiant Energy Source
Form of energy traveling in waves, especially electromagnetic radiation producing heat and/or light.

Renewable Energy Sources
Those that can be used up and can also be replaced.
List three renewable energy sources.
1. ______________________________________
2. ______________________________________
3. ______________________________________

Millions of years ago plants and animals lived and died in forests and swamps which covered parts of the earth. New plants grew and died on top of them, gradually developing thick layers of rich, decayed materials. The land eventually sank and water covered it. The great pressure of the water, in addition to bacterial action and heat, changed the materials into "fossil fuel."

Fossil fuels include coal, natural gas, and petroleum. These materials are high-energy sources, producing energy in concentrated form. These fossil fuels are the energy sources used to produce gasoline and electricity, and they have many other energy-related uses. Because of the unique way these fossil fuels developed, there will be no more to replace them when they are used up. Therefore, they are called nonrenewable sources. There is much concern about the rate at which we are using these nonrenewable fuels and what we will do when the supply has been exhausted.

Fossil Fuels
Aged remains of plant and animal life dug from the earth and used for fuels such as petroleum, coal, and natural gas.

Nonrenewable Energy Sources
Sources of energy that cannot be replaced or renewed.

List three nonrenewable sources of energy and give an example of how each is used in today's world.
1. ______________________________________
2. ______________________________________
3. ______________________________________
Let's see how well you understand renewable and nonrenewable energy sources. In the blank in front of the energy sources listed below, write R for those that are renewable and N for those that are nonrenewable.

____ gasoline  ____ windmill  ____ solar energy  ____ petroleum
____ falling water  ____ natural gas  ____ firewood  ____ coal
____ kerosene  ____ diesel fuel  ____ human energy  ____ animal energy

There are other forms of energy. For example, chemical energy is used in the batteries of your car and flashlight. Sound energy may cause the speakers of your stereo system to "blow up" if the volume is too high. Sonic booms from airplanes can break windows. Light energy is used in a laser for cutting in some types of surgery. It is also used in scanners that read Universal Product Codes at the supermarkets. Nuclear energy is a very powerful force which has caused much discussion. It is being used on a limited basis to generate electricity. Scientists have much to learn about controlling and using energy sources such as lasers and nuclear fusion and fission.

Energy can be changed from one form to another for use. The burning of coal transforms stored energy into heat and light. Your flashlight changes chemical energy into light. At a waterfall, the energy of motion can be changed into electrical energy by using a generator.

Even though scientists are trying very hard to harness other energy sources, most of the energy we now use in our homes and factories comes from the nonrenewable energy sources: coal, natural gas, and petroleum. They contain high concentrations of energy and are easy to use. There is much concern about what will happen when our supplies are used up. At this time there are no known energy sources that are concentrated, dependable, and abundant enough to replace them. Americans use a lot of energy — much more than do other nations. For these reasons we must learn to avoid wasting energy. By using energy wisely and conserving it, we can make our energy sources last longer.

Laser
Device used to concentrate and focus light waves into a narrow, very concentrated beam.

Fission
Splitting the nuclei of an atom into two or more parts and releasing energy.

Fusion
Changing two or more nuclei of atoms into one heavier nuclei, making a different element.

Chemical Element
A substance that can’t be divided without making it into another element.
You use electricity for many of the things that you do. Energy, in some form, is required to turn the turbines to generate electricity. This energy used to turn the turbines may come from falling water, burning coal, natural gas, or petroleum. A small amount comes from nuclear fission.

Since Florida does not have waterfalls or swiftly moving streams, there is very little hydroelectric power produced in the state. Instead, nonrenewable energy sources such as natural gas, fuel oil, and coal must be used for generating the electricity.

Hydroelectric Power
Produced by falling and/or moving water.

What kind of fuel (energy) is used to generate the electricity used in your home?

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**Talk with your grandparents, or someone over 50 years of age, about how they did things when they were young.** You will find they did not have many of the conveniences or luxuries that you enjoy. They did many things differently.

Who did you interview? ______________________________________

Did you talk with them _____ separately, or _____ together?

Were you surprised at some of the things that you learned? ______________________________________
How Energy is Used

Compare the way you do things now with the way they were done 50 years ago. This will help you to understand how these changes have affected our use of energy. Write N in the blank space beside the activities that use nonrenewable energy sources.

<table>
<thead>
<tr>
<th>50 Years Ago</th>
<th>Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ Dry your hair</td>
<td>_____ Blow-dry your hair</td>
</tr>
<tr>
<td>_____ Light the kerosene lamp in your room</td>
<td>_____ Turn on the light in your room</td>
</tr>
<tr>
<td>_____ Pump water from the well</td>
<td>_____ Turn on the water in the bathroom</td>
</tr>
<tr>
<td>_____ Cook dinner on a wood-burning stove</td>
<td>_____ Cook dinner</td>
</tr>
<tr>
<td>_____ Read a book</td>
<td>_____ Watch T.V.</td>
</tr>
<tr>
<td>_____ Walk to school</td>
<td>_____ Go to school in a bus</td>
</tr>
<tr>
<td>_____ Go shopping by riding in a buggy</td>
<td>_____ Go shopping by riding in a car</td>
</tr>
<tr>
<td>_____ Play a harmonica</td>
<td>_____ Play a radio</td>
</tr>
<tr>
<td>_____ Store food in the ice box</td>
<td>_____ Store food in the refrigerator</td>
</tr>
<tr>
<td>_____ Brush your teeth</td>
<td>_____ Brush your teeth</td>
</tr>
<tr>
<td>_____ Mow the lawn</td>
<td>_____ Mow the lawn</td>
</tr>
<tr>
<td>_____ Iron clothes</td>
<td>_____ Iron clothes</td>
</tr>
<tr>
<td>_____ Heat water for a bath</td>
<td>_____ Heat water for a bath</td>
</tr>
<tr>
<td>_____ Sew clothes (treadle sewing machine)</td>
<td>_____ Sew clothes</td>
</tr>
<tr>
<td>_____ Keep warm with quilts</td>
<td>_____ Turn on the electric blanket</td>
</tr>
</tbody>
</table>

1. How many of the above-listed activities used nonrenewable energy sources 50 years ago? _____
2. For how many of the above-listed activities do you use nonrenewable energy sources? _____
3. What does this show about your use of electricity? ____________________________

It's time for you to do some exploring to learn how energy is used in your home; how energy was used in your parents' homes when they were your age; and the way your grandparents used energy at your age.

Make an appointment with one of your parents or guardian and with your grandparent or a person of about the same age. You may wish to talk with them separately or together. They might have fun sharing past experiences about things they did when they were your age. Using the check sheet on page 8, ask them to tell you which items were in their homes when they were your age. Place a check by each item that was in the home.
<table>
<thead>
<tr>
<th>Type of Machine or Appliance</th>
<th>Used By You</th>
<th>Used By Your Parent (When Young)</th>
<th>Used By Your Grandparent (When Young)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric or Gas Range</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microwave Oven</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic Coffeemaker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Mixer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Processor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Dishwasher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Can Opener</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Clock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Fan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Conditioner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Lights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic Clothes Washer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clothes Dryer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuum Cleaner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Garage-Door Opener</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Blanket</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Hair Dryer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Curlers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record Player</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Television</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Drill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Circular Saw</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Toothbrush</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Lawn Mower</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric (rechargeable) Flashlight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Well Pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space Heaters (gas or electric)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. How many more appliances did your parent use than did your grandparent? ________________
2. How many more appliances are in your home than were in your parent's home? ________________
3. What do you like about being able to use energy to operate machines and appliances? ________________________
4. What do you dislike? ________________________________________________________________
5. How many things do you own that use energy, for example, a radio? ________________________
   List them:_________________________________________________________________________
6. What is your favorite machine or appliance that uses energy? ____________________________
   Why? ____________________________________________________________________________

**Wasted Energy**

It's time to do some more exploring. You have found that you use many things that require energy to operate. Now, you are to investigate how wisely you and other family members use energy. Many people waste energy through carelessness.

Visit each room in your home. Look around the room for things that use energy. Check to see if each is turned on or is operating. If so, is it being used by someone? Or, is it turned on but not being used? For example: Is the television operating while no one is listening? Are lights left on when no one is in the room? Did someone leave the hot water running in the bathroom or leave the front door open when the air conditioner is operating?

*Check each room in your home for appliances and other things that use energy. If something is operating when no one is using it, record it in the space below. This will help you to recognize places where energy is wasted.*

<table>
<thead>
<tr>
<th>Room</th>
<th>Energy-using item</th>
<th>What is happening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: Bedroom</td>
<td>Electric blanket</td>
<td>Left turned on</td>
</tr>
</tbody>
</table>

Total number of items wasting energy ________________________
Let's take an imaginary trip to a land that uses only renewable energy sources. In this land nonrenewable energy sources do not exist.

- Do you think life would be very different if you lived in a land that used only renewable energy sources? ____________ Why? ____________________________

- In this land, where would you get your food? ____________________________

- Describe how it would be grown. (Remember that chemical fertilizers are made from fossil fuels. Metal tools and plows are not available in Nature Land, because without fossil fuels it is difficult to mine and refine the ore.) ____________________________

- In what forms would you be able to buy food? ______________ Why? ______________

- How would you cook your food? ____________________________

- What kinds of utensils would be used for cooking? ____________________________

- How would products be packaged? (No plastic in Nature Land) ____________________________

- How would products be transported to market? ____________________________

- How would factories operate? ____________________________

- How would cloth be made? ____________________________

- How would you sew your clothes? ____________________________

- How would the absence of fossil fuels (nonrenewable energy sources) alter your lifestyle? ____________________________
The Electric Meter

Electricity used in the home is measured by a kilowatt-hour (kwh) meter. A kilowatt meter consists of a chamber containing a special motor and a series of cogwheels. The electric current going into the home passes into the meter chamber and through the motor. The motor armature connects with the cogwheels, causing the wheels to turn. The cogwheels are attached to the recording device. The amount of electric current passing through the motor is registered on the front (or face) of the meter.

There are two types of electric meters: the cyclometer and the dial. The cyclometer contains space or cutout windows where numbers appear as the cogwheels move the registering device. It is the easiest type of meter to read, and it is read the same way as your car’s odometer.

Some meters have four windows. Others have five windows. If a meter has four windows, you must multiply by 10 to obtain the same reading given on your utility bill. For example, the reading shown on the meter to the right is 54,790 kilowatts. The last number on the right side of the meter changes when 10 kwh have been used. For example, the 79 on the meter shown would become 80 when 10 kwh have been used. If the meter has five windows, it is read the same way. However, you do not multiply by 10. This type of meter shows each kwh as it is used.

More skill is needed to read a dial meter. The face of the meter contains small dials that must be read to get the kwh reading. Dial meters are of two types. One type has four dials. The other type has five dials. Both types of meters are read in the same way except that you must multiply the reading of the four-dial meter by 10.

Study the diagram of the four-dial meter and notice that each dial looks similar to the face of a small clock, but there is only one hand — the pointer. Notice that on some dials the numbers start on the right side and progress clockwise around the face of the dial. The hand also moves clockwise (toward the right, similar to a clock). On other dials the numbers start on the left and the hand moves toward the left, or counterclockwise.

The dials are connected by a system of cogwheels. This makes it necessary for each dial to be numbered in the reverse direction from the dial in front of it and the one behind it. As electricity passes through the meter, the pointer on the dial turns. When the pointer on the right-hand dial makes one complete revolution, it causes the next dial on the left to turn from one digit to the next — only one-tenth of a revolution.
Read the Meters

Now you are going to learn to read electric kilowatt-hour meters. You will find out how much electricity is used in your home. By reading the meter you can learn which activities use the most electricity.

It is easy to read the cyclometer. Read it as you would read the odometer of a car. (Don't forget to multiply by 10 if there are only four windows.)

To read the dial meter, you must read the numbers from all of the dials. One easy way to do this is to write down the readings from each of the dials. Let's practice reading a dial meter. Study the picture below. Now, read the dials. Start with the last dial on the right. To determine the reading of each dial, read the digit that the pointer has just passed. Start with the end dial on the right side of the meter. Write the reading of each dial in the space below the dial.

If you are in doubt as to whether a digit has been reached or passed, look to the dial on the right to see whether the revolution has been completed. It is completed if the pointer on the right meter has passed zero and is moving toward the one.

The numbers on a meter can't be reset or turned back to zero when the meter is read each month. To find how many kwh of electricity were used, you must subtract the last reading from the present reading. The difference between the two readings is the kilowatts of electricity used.

If the pointer has passed zero, you will record the larger digit — the one nearest the pointer. In this example the left reading is seven.

If the pointer has not passed zero but is near it, you will record the smaller digit. In this example the left reading is six.

What is the reading of this dial meter? ___________ (Read these figures as you read any other number, from left to right.)
Suppose your meter reading was 23,571 at the first of the month. If you read the numbers from the dial meter on page 12 at the end of the month, what would be your kilowatt usage for the month? (Show your work in the space at right.)

Tip: Subtract 23,571 from the reading taken at the end of the month.

Reading at end of month

Reading at first of month

Kilowatt hours of electrical energy used during the month.

Monitor Energy Use

You are now ready to become a meter watcher and to monitor the use of electrical energy in your home. Watch the meter when the electric stove, air conditioner, or electric iron is on. Watch the little flat wheel in the center of the meter; notice that the faster it turns, the faster the pointers turn. Look at the meter again when almost everything is turned off. You will notice that it turns much slower. If the meter has five dials or numbers, it is easier to see how fast the meter is turning. This is because the last dial or number measures each kwh. On four-dial or number meters, the last dial or number measures each 10 kwh used.

Let's see if there is a difference in how fast appliances use electricity. To do this, let's see how long it takes small motor-driven appliances, such as an electric toothbrush or mixer, to use one kwh. Compare this time with how long it takes a heating appliance, such as an iron or an electric oven, to use one kwh. If your electric meter has only four dials, you will have to use 10 kwh for the meter readings to change.

Monitor
A person who advises, keeps records, and warns or cautions.

Watt (w)
A unit of electric power.

Kilowatt (kw)
One thousand watts.

Compare the energy usage of different types of electrical appliances.

■ Read the meter and record the reading ___________; Time of day ___________.
■ Turn on two or three of the following appliances: electric oven, clothes dryer, iron, electric frying pan, hair blow-dryer (on high setting), electric heater, toaster, and waffle iron.
■ Let the appliances operate while you watch the meter.
■ When the dial or number on the right side of the meter has moved one digit, record the time ___________.
■ Turn off the appliances.
■ How long did it take the appliances to use one kwh? ___________
(Or, 10 kwh for four-dial or number meters. ___________.)
You are now ready to do the other part of your experiment.

- Record the meter reading ___________; Time of day ___________.
- Turn on two or three of the following appliances: electric toothbrush, blender, electric mixer, radio, television, electric drill, electric clock, and electric pencil sharpener.
- Let the appliances operate while you watch the electric meter.
- When the dial or reading on the right side of the meter has moved one digit, record the time ___________.
- How long did it take the appliances to use one kwh? ___________
  (Or, 10 kwh if the meter has four dials or numbers. ___________)  

You are now ready to compare your findings.

- Which heating appliances did you use? ______________________________________
- Which smaller motor appliances did you use? __________________________________
- Which required the least amount of time to use one kwh of electricity? ______________
  (Or, 10 kwh of electricity? _________________.)
- What was the difference in the amount of time required? _________________________
- Which type of appliance uses the most energy? ________________________________

You have learned to read the electric meter. Share this information with someone. Teach a family member or a friend to read electric meters. By reading the meter weekly, a family can know how much electricity is being used. This helps control the amount of electricity being used.

Ask your family to cooperate with you in the next activity. You will learn how much electricity is used in your home weekly. You will learn that with cooperation family members can reduce their energy usage. Your parents will be very interested in saving energy because it will reduce the utility bill.

**Kilowatt hour (kwh)**

One kilowatt used for 1 hour, or 1,000 watts used for 1 hour, or 2,000 watts used for a half-hour.

**Energy conservation experiment**

- Read the electric meter. Write the meter reading. ________________________________
  Record the date and the time of the reading. ________________________________
- One week later read the meter again. The reading is ________________________________.
- Subtract the first reading from this one. How much electricity was used during the week? ________________________________
- Was this a week of normal activity? _____________ If not, repeat experiment.
Get your family together. *Talk about ways you can save electricity. Ask everyone to help. Develop a plan and write it down. Post the plan where everyone can see it. Ask all members to carefully follow the plan for one week and to help other members to follow it.*

- Read the meter at the beginning of the week. The reading is ____________________________.
  Date: __________; Time of day: __________.
- Read the meter at the end of the week. The reading is ____________________________.
  Date: __________; Time of day: __________.
- How many kwh were used? ____________________________
- Did you use less electricity than during an average week? ____________________________
  If so, how much electricity did you save? ____________________________
- List some of the things done to save electricity. ____________________________
- Will you and your family continue to try to save energy? ____________________________
  Why? ____________________________

**Project Report**

You have learned to identify renewable and nonrenewable energy sources. You have compared the energy usage of yourself, your parents, and your grandparents, and you have learned to read your electric meter.

Briefly tell why you think America has an energy problem and what we need to do about it.

______________________________________________________________

______________________________________________________________

______________________________________________________________

Tell what you are doing to try to conserve energy and any results you have seen from your efforts.

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________
How many people did you teach to read the electric meter?

Why do you think energy conservation is important?
This publication was produced at a cost of $522.25, or 26.1 cents per copy, to teach youths about sources of energy and conservation techniques. 9-2M-87

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