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ABSTRACT

This publication on energy conservation is designed as a resource material for the classroom. It is divided into three chapters concerning a definition of energy, the conservation of energy, and the uses of energy. For each subtopic within the chapters, there is background information and suggested project topics designed for secondary school students. A brief glossary at the end of the booklet defines some of the energy related terms used in the text. A short bibliography and a listing of resource people are included at the end. (MA)

Energy Conservation

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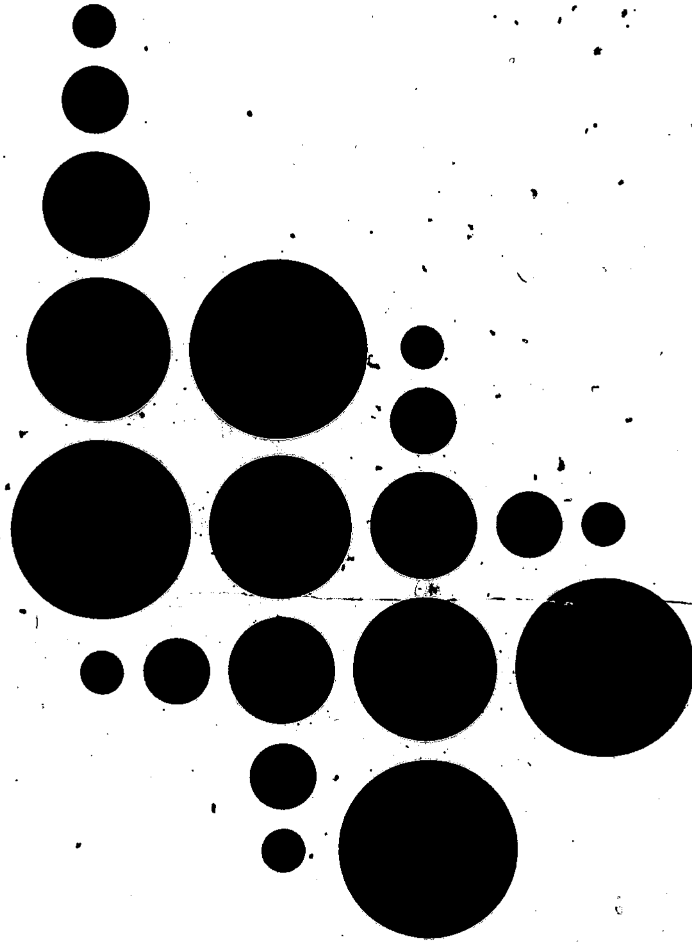

Energy

Understanding and activities for young people

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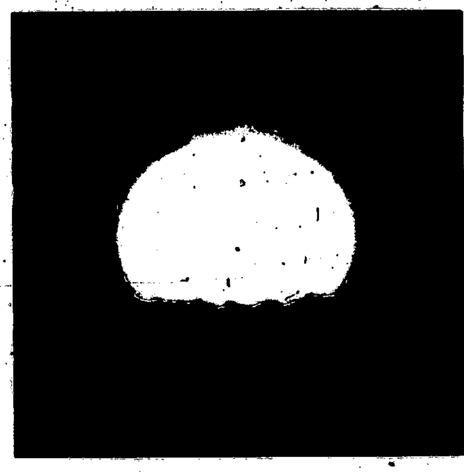
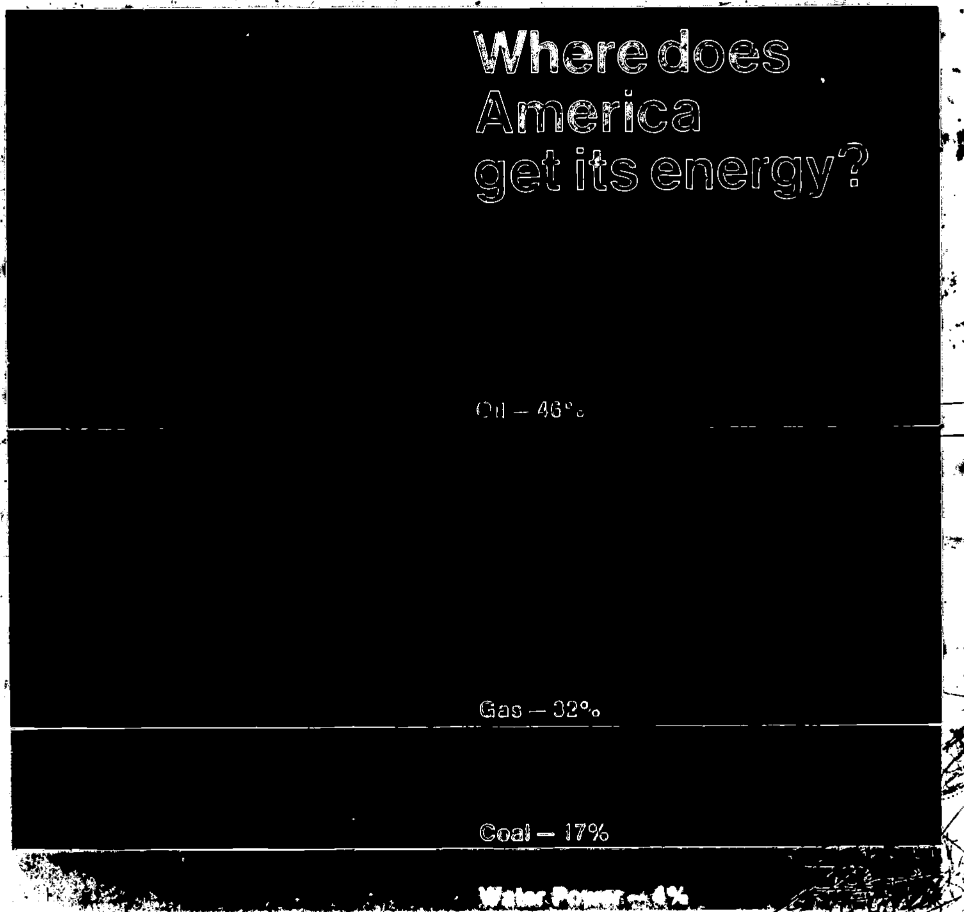




What Is Energy?

We hear a lot about energy these days. Energy is very important to all of us. We use it in many forms each day. We can't see it, but we can see and feel what it does.

The word "energy" can have a number of different meanings, but in this book energy will be used as it is by scientists and engineers. It will be closely associated with two other words which have special meanings to the scientist: "work" and "power."

The scientist says we do "work" when we push or pull something for some distance: "energy" is the capacity to do work, that is, the ability to make something move: and "power" is the rate at which energy is produced or used.

When you raise your arm you use energy. The bus going down the street and the plane flying overhead are using energy. The energy we see in the motion of objects is called "mechanical energy." But energy exists in many less obvious forms. *Heat* is a form of energy, and so is *electricity*. *Chemical* energy holds materials together, and the water behind a dam or a rock on the top of a cliff are forms of *potential* energy.

All these forms of energy are useful to us because we can store energy in one form, transform it to another, transport that from place to place, and then transform it again to do work for us. For example, coal stores chemical energy. It can be burned to make heat energy. Heat can run a generator to make electrical energy. The electricity passes over wires to run a motor and the motor can beat our eggs.

You can see how important energy is. But, is there enough energy to do all the things all the people on earth want?

The fact is that most of the energy we use today in the United States comes from oil. The world has a 30- or 40-year supply of oil left; most of that is in foreign countries, and its price has risen sharply. What will we do when we run out of oil?

An average person in the United States uses as much energy as 25 people in some other countries, such as China. All of those billions of people would like to live as well as we do. Could we possibly find enough energy to meet all their needs?

A Project To Do: An Energy Chain

Select any item you can see in your home, school, or street. List the kind of energy associated with it. What energy makes it run? Does it transform energy from one kind to another? Does it store energy? What kind? What kinds of energy were used in its manufacture? What energy do you need to use it?

Write a one-page essay describing the energy chain associated with the object you chose.

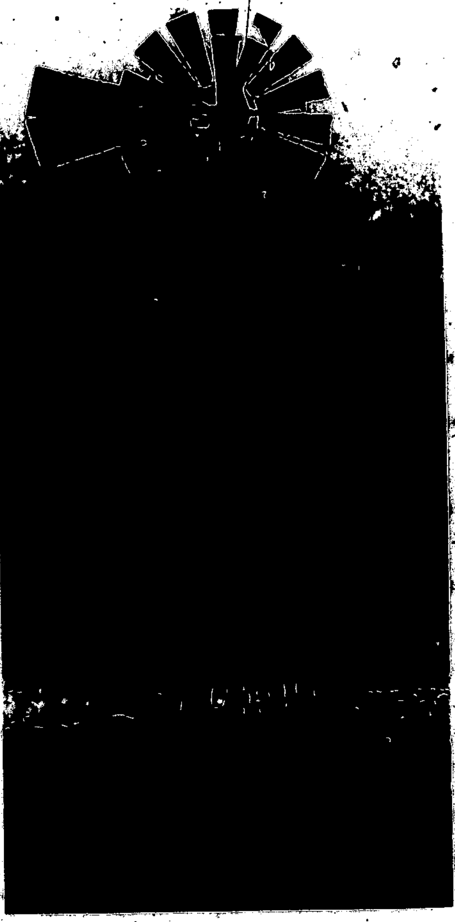
Where Does Energy Come From?

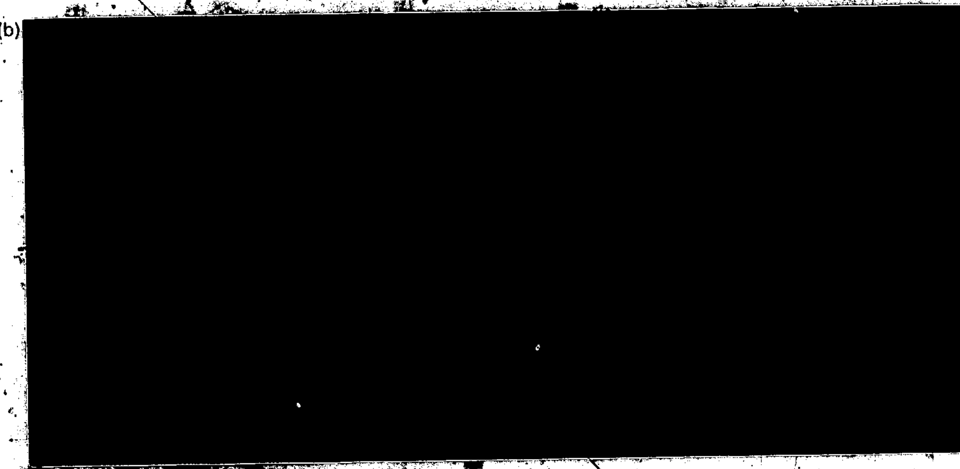
Fossil Fuels

Millions of years ago, plants lived and died in forests and swamps which covered parts of the earth. New plants grew and died on top of others; and this chain of growth and decay formed a rich, soft material that looked like rotted wood. Over millions of years, the earth's surface sank, and water from the oceans rolled over the layers of rotting plants. The immense pressure and weight of the water, plus heat and bacteria, changed the rotting plants into "fossil fuel"—coal, oil, and natural gas.

Petroleum

One of the most important fossil fuels is petroleum, or crude oil. Oil is trapped in porous rock beneath the surface of the earth. To find it, we must often drill thousands of feet. Drilling rigs can be set up on land or in the ocean, wherever oil can be found. Taking oil from where it is discovered





(a) **Windmills** harness a free source of energy.
(b) **Electricity** is our most useful form of energy.
(c) **Water power** has been used for centuries.

however, requires a great deal of human and machine energy. At the present time, we don't produce enough oil in our country to fill our energy needs and must import one-third of our oil from foreign sources.

Every day we use products made from crude oil. Some is used as heating oil to keep our homes, apartments, and office buildings warm. Some is used as gasoline and motor oil for our automobiles, trucks, and buses. Kerosene for jet aircraft, diesel fuel for trucks and machinery, and asphalt for our roads all come from petroleum.

Oil is also used as a feedstock, or raw material, to make new products and conveniences. The plastics industry uses petroleum to manufacture packaging, furniture, and toys. Manmade fabrics, such as nylon, have been developed from petroleum. Even some medicines are derived from petroleum, as are many chemicals and fertilizers.

Natural Gas

Natural gas is the cleanest burning of the fossil fuels. It is usually the most convenient fuel to produce and use. Natural gas is trapped in layers of rock frequently found with oil deposits. The United States still has untapped reserves of natural gas, but the methods of recovering it are expensive. Sometimes we must drill such deep wells to recover new natural gas that we use more energy than we produce.

In 1973 natural gas accounted for 31 percent of the United States' energy needs. Natural gas is used for heating buildings and water, industrial processing, and for cooking. Some scientists say that there will be no natural gas left by the year 2000 if we continue to use it at our present rate.

Coal

Coal is our Nation's most abundant fossil fuel. It is used to generate electricity and in industries such as steel. Two methods of mining coal are used today: strip or surface mining and deep or underground mining. Current coal production is almost evenly divided between these two methods.

Surface mining, used when the coal lies close to the surface of the earth, is done by giant shovels that strip away the earth on top of the coal seam, and then scoop the coal from the earth — the land is "stripped" away. Most of the mining in the West is surface mining. But in the East, coal is mined by both surface and underground mining.

Underground mines are tunneled beneath the surface of the earth to reach the coal. Our oldest major deep mining area stretches along the Appalachian Mountains from Pennsylvania to Alabama.

There are great reserves of coal in the Western States. Western reserves have been developed slowly because of lack of industry and water in the areas near the coal and because of concern for the environment. The costs of land reclamation must now be considered in the overall cost of coal production.

Renewable Energy Sources

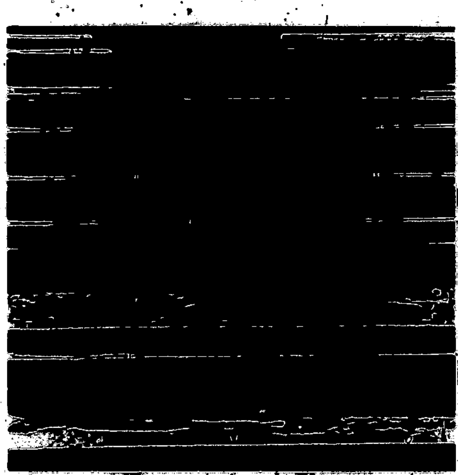
Geothermal Energy (Geo-Earth; Thermal-Hot)

The problem of disappearing fossil fuels is being tackled by imaginative people who want to use fuels which are "renewable" — fuels which cannot be "used up." Sources of energy such as water, wind, and the sun are renewable.

There are many places where the natural heat of the earth combines with underground water to make steam. This steam is harnessed to run generators to produce electricity. (Geysers like Old Faithful in Yellowstone National Park are examples of steam power.)

Natural hot water can be used to heat buildings as is done in the entire city of Reykjavik, the capital of Iceland. Boreholes are drilled in the earth near hot springs. Water captured from

(a)



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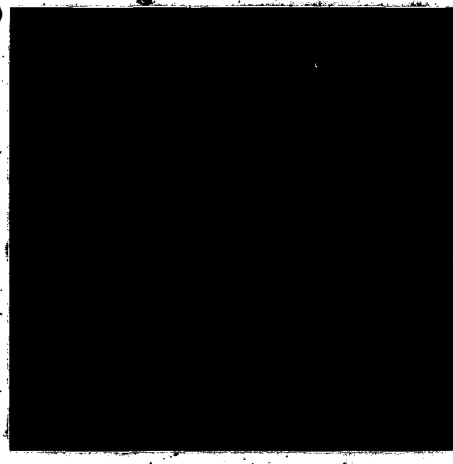

(a) **Railroads** provide a very efficient means of transportation.
(b) **Highways** have been built for business and pleasure travel.
(c) **Jet aircraft** provide our fastest but most "energy-intensive" means of travel.
(d) **Many products** are made from petroleum.
(e) **Gas meter** measures use of natural gas.
(f) **Coal** is our most plentiful fossil fuel.
(g) **Lighting** our cities requires vast amounts of electricity.

these holes is pumped to storage tanks and pumping stations and then to the consumers.

Geothermal heat is clean and much less expensive to use than that from fossil fuels. However, the steam produced sometimes contains objectionable gases, and hot spring water sometimes contains more dissolved solid materials than are considered safe and manageable. Also, much of the earth's heat is buried so deep that it is not now useful. At the present time it does not pay to drill more than 10,000 feet to get the earth's heat. Scientists and engineers are working to overcome these problems. Most of the potential for geothermal energy in this country lies in California, Montana, and other Far Western and Gulf Coast States.

Solar Energy

The sun is our major source of energy. Its energy is used in many ways. The sun gives us energy as light, it is absorbed and used by plants to manufacture food, and it gives us heat, which we have just started to learn how to use. The energy provided by the sun is renewable and clean.

The most practical use of solar energy today is in direct conversion to heat. One method widely used consists of a flat surface to absorb the sun's heat. The heat is transferred to air or to a liquid, usually water, which is then circulated to a container where the heat is stored or used.

Within the next few years we may see the sun's energy used for heating and cooling buildings. Nearly one-fourth of the energy used in the United States is used for heating, cooling, and supplying hot water for buildings. Solar energy could greatly help in our effort to use less of our nonrenewable fuels.

Many experimental homes are already partially heated by different kinds of solar systems. These are being carefully studied to show how the design of new houses should be changed to make more efficient use of solar energy. Some schools have recently been equipped with experimental solar heating systems.

A second use of solar energy is the solar cell, which absorbs energy from the sun and converts it directly to electricity. This system provides most of the electricity used on unmanned space flights. This system is still much too expensive for home use. In the future, research and mass production may cut that cost enough to provide another new source of electricity.

Solar energy is also transformed by plants into stored chemical energy in a process called *photosynthesis*. Some scientists think that we can develop "solar plantations" with special plants grown to produce energy. We can get energy from plants by burning them or by changing them into other chemicals such as methanol to substitute for gasoline.

A Project To Do: A Solar Information Clearinghouse

Homes in almost every part of the country are already using solar energy. But many builders do not know how to get solar panels or design solar homes. Start a solar clearinghouse for the local library or technical school. Find all the articles you can on solar heating. Ask local architects to help. Include the location of nearby solar-heated homes in your clearinghouse. Tell local contractors about your project and ask them for any information they may have.

Wind

The source of wind power is the sun. Wind energy is a secondary form of solar energy. Man has harnessed wind to do his work for centuries. In our own American West, windmills pumped water, sawed wood, and generated electric power for half a century. From 1880 to 1930, over 6 million windmills generated electric power in the West. After that, cheap fuels were found to be better. Now that

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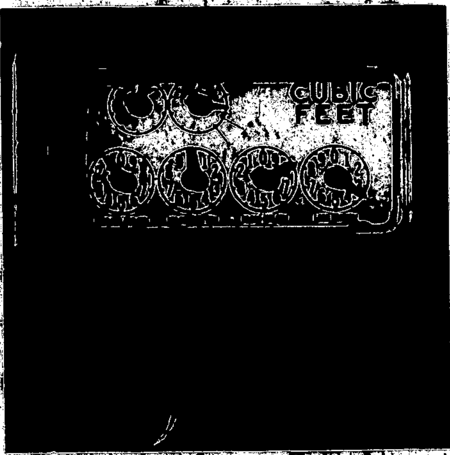

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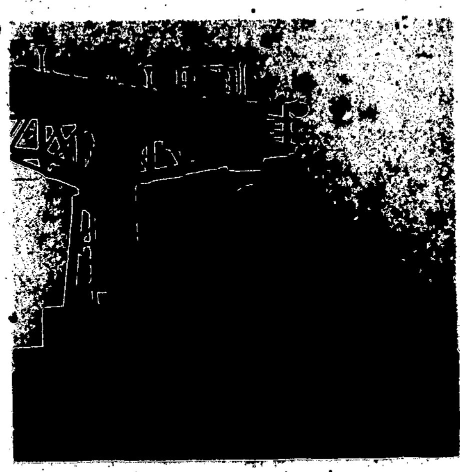


(g)

fuel is expensive, there will be more need for a modern kind of windmill.

Winds strong enough to use are found in the Great Plains and the Northeast States. We have seen that the Western pioneers made great use of the winds on the plains. The wind averages more than 12 miles per hour on the Western Plains and in the Northeast. It is strong and constant enough to be of real value. Practical wind-driven powerplants could probably generate nearly 20 percent of our electrical needs by the year 2000.

Someday, we may have large-scale wind generators to serve millions of people rather than just one house. They could give us clean, cheap power. However, scientists must learn more about wind behavior to find out how much power can be generated and the most efficient equipment to use. Much of the work and the experiments that have been done for the aircraft industry on the movement and effects of wind will help in developing wind power. Experimental wind power systems are planned to make enough electricity to serve about 100 homes, and later as many as 10,000.

Electricity

Electricity is a form of energy caused by the presence and motion of electrons, protons, and other charged particles. Electricity can be seen in nature as lightning. It can be felt as a spark when you rub your feet along some carpeting and then touch another person or object. Commercially, electricity can now be created from all fossil fuels, water power, chemical reactions, nuclear fission, the wind, and the sun. More and more of our energy needs are being supplied by electricity.

Electricity is one of our most useful forms of energy. It can light, heat, and cool our homes, schools, and office buildings. It is the basis for radio, telephone, and TV. In addition, most of our labor-saving devices depend on electricity for power — clothes washers and dryers, dishwashers, water heaters; these and many more home appliances place heavy demands on our electrical supplies.

A Project To Do: Reading the Meter

Electric meters measure the amount of electricity used. The measurement is kilowatt-hours. (1 kilowatt = 1000 watts.) This is the amount of electricity needed to burn 10 100-watt light bulbs for 1 hour. (10 bulbs x 100 watts x 1 hour = 1000 watt-hours, or 1 kilowatt-hour.) Most electric meters have a set of dials which are read in multiples of 10. The dial on the far right indicates tens of kilowatt-hours; the next one, hundreds of kilowatt-hours; the next dial, thousands of kilowatt-hours, and so on. Reading the dials can be tricky because some of the dials read clockwise, others counter-clockwise. When the pointer is between two numbers, take the lower number.

The illustrations on page 6 show different sets of meters. Can you read them? We've put the answers upside down, so you can check yourself.

Hydropower

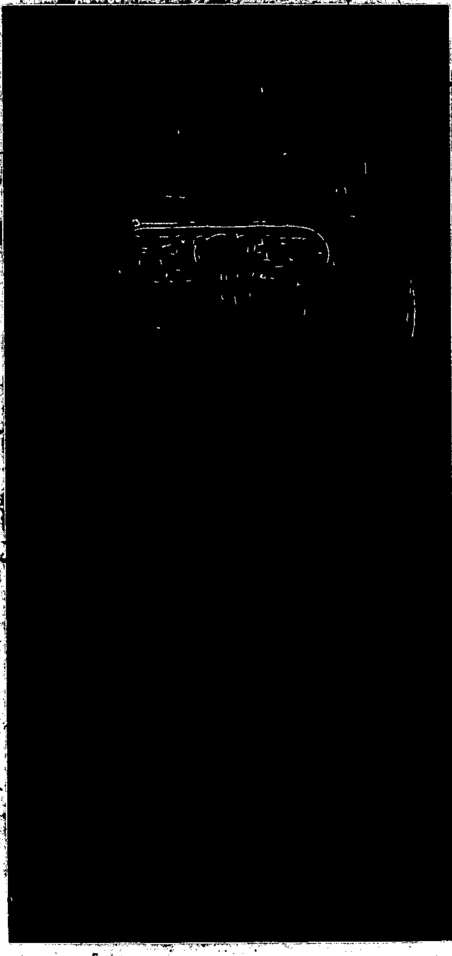
One of the earliest forms of energy used by man was the energy of flowing water.

If you travel around the country, you can still see early water wheels which transformed the energy of flowing water into mechanical energy to grind wheat, run textile mills, and do many other forms of useful work.

Water power is an important source of electrical power. Huge dams were built on our largest rivers to harness this form of energy. Water from these dams goes through sets of propellers like fan blades, called turbines. Turbines make huge magnets whirl past coils of wire, creating electricity that is sent out for distribution to homes, factories, schools, and cities.

Nuclear Energy

All the material around you is a very concentrated form of energy. But we do not yet know how to easily change this "mass" into useful energy.

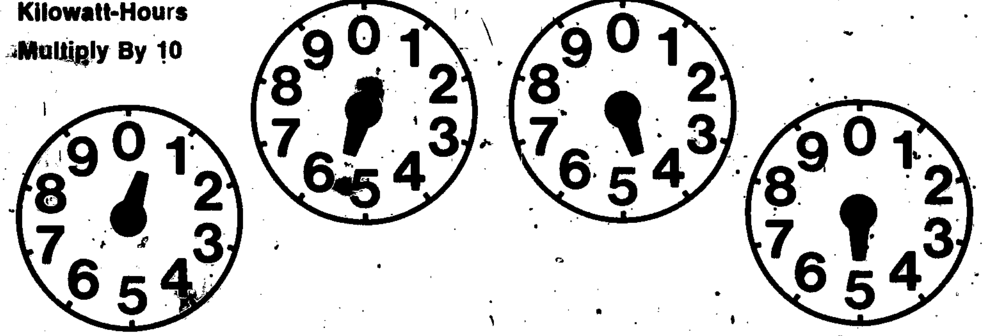


Kilowatt-Hours
Multiply By 10

READING = ______ **kilowatt-hours.**

Answer: 79,420 kilowatt-hours

Kilowatt-Hours
Multiply By 10



READING = ______ **kilowatt-hours.**

Answer: 5,450 kilowatt-hours

The only practical way scientists have yet found to change mass into energy is by "nuclear fission."

Nuclear fission takes place when the heart or core of a very big atom is broken into two or more parts. Even a very big atom is very small, smaller than anything a person can see even with the most powerful microscopes. The atom is the smallest part of matter that can still keep its chemical properties. It is composed of a center, the nucleus, surrounded by a swarm of electrical particles called electrons. If we can hit the correct atomic nucleus just right with another particle, called a neutron, we can make it explode, giving off energy, radiation, and a shower of other neutrons. If one of the new neutrons hits another nucleus, that too can explode, and we may set up a "chain reaction" of many exploding nuclei. This chain reaction is difficult to control; it is hard to keep the reaction going, and there are problems in getting just the right amount of energy we need.

Engineers have succeeded in designing nuclear powerplants to take advantage of the energy stored in the atom. Since 1 pound of nuclear fuel such as uranium, thorium, or plutonium can give off as much energy as 3 million pounds of coal, it is easy to ...e that nuclear power can be an im...rtant way to conserve fossil fuels.

Today, only about 1 percent of our energy comes from nuclear powerplants. But, over half the new electrical powerplants being built or planned are nuclear powered, so nuclear fission will become more important in the future.

There is another way to get energy from the atom which may someday prove to be a major source of energy. That is "nuclear fusion." Whereas "fission" is the breaking apart of heavy nuclei, "fusion" is the sticking together of very light nuclei, such as those of hydrogen or helium. Scientists still need to come up with a major breakthrough before nuclear fusion can be harnessed, but many laboratories around the world are working on nuclear fusion.

There are serious problems which must be overcome if nuclear power is to become an abundant source of electricity in the future. Nuclear power is relatively expensive. Nuclear powerplants must be safeguarded from explosion, radiation leak, or theft of material which could be used for nuclear weapons. Our environment must be kept safe from the radioactive wastes generated by these plants, and from the heat ("thermal pollution") which could upset the balance of nature in nearby waters. All the safeguards that we rightfully demand for protection and reliability will add to the expense of nuclear power, just as they will insure that such energy converters are "good neighbors."

The Future

Solar, wind, geothermal and nuclear energies are resources of the future. Today, no more than 3 percent of our Nation's energy is supplied by these sources.

There are many other potential sources which also need more study and development. Currently the United States disposes of millions of tons of organic wastes, neither returning the valuable organic materials to the soil nor converting them to useful energy. Some of these waste materials could be converted to methanol to substitute for gasoline, to methane to increase our supply of natural gas, or burned directly as solids, like wood which was our principal source of power in the 1800's. Tidal power, fuel cells, ocean currents, ocean thermal differentials, free hydrogen and osmotic pressures are other potential energy sources being examined as future supplies.

In spite of these potentials, for a long time yet, oil, natural gas, and coal will have to be our major supplies of energy, and these are in dangerously short supply.


Chap

How much energy can be saved by recycling?

New aluminum uses 20 times as much energy as recycled aluminum.

New paper uses twice as much energy as recycled paper.

Artificial fabrics use 10 times as much energy as natural fabrics.

Energy Conservation

Energy Conservation Saves Our Resources

For years we have used energy as if we would always have as much as we could ever need. Scientists and engineers always seemed able to find new sources of energy, new ways to make it cheaper, and new ways to use it to make life more pleasant.

Not only has the amount of energy each person uses grown over the years, but the number of people using energy has also grown. In 1900 there were 75 million people in the United States and each person used 100 million BTU's of energy. Today, there are over 211 million Americans, each using 300 million BTU's of energy. At this rate, all our energy supplies will soon be gone. Already we can estimate how long our fossil fuels will last.

Coal is by far our largest fossil fuel resource. At current rates of use, the United States has more than a 500-year supply. However, as our available petroleum and natural gas reserves are used up, we can expect coal to be used at even faster rates in the future. Coal may then be substituted for oil and natural gas. If this happens, then our coal supply may run out much sooner than expected.

Of course, some new oil and natural gas may be discovered which could extend the time before all our fossil fuels are gone. But only by conserving energy — by using less and stretching out our remaining supplies — can we really count on having the time we need to develop new energy sources in the form of solar, geothermal, and nuclear power.

A lot of energy is used by industry to process and manufacture the many things we buy. Generally, products made from used or recycled materials take less energy to make than do products made from new materials. For example, it takes only about 25 percent of the energy to make steel from scrap steel as it does to use iron ore; for aluminum, the figure is less than 5 percent; for copper, 5 to 10 percent; and for paper, 60 to 70 percent.

In the same way, throwaway bottles and cans represent wasted energy, as well as wasted materials. Usually, returnable containers for beverages need only one-fourth as much energy as one-way bottles and cans.

A Project To Do: Recycling

You can help conserve our supplies of energy by supporting your local recycling center.

At home, separate into different containers clear glass, green glass, amber glass, aluminum, and other metals. Find the nearest recycling centers for each material and be sure your collections are taken there.

Energy Conservation Protects The Environment

The more energy we use, the more we pollute our environment. This happens in a number of ways. The exhaust fumes from automobile engines are the source of 60 percent of the air pollution throughout the United States. Even small amounts of these gases can injure plant life and human health. Sometimes sunlight and weather will interact with auto exhaust to produce a condition we call "smog." Smog is highly irritating and can cause problems in breathing. It can even contribute to the deaths of persons already weakened by age or illness.

Production of oil can also endanger the environment. The nature of the hazard depends on whether the oil is drilled on land or offshore. Wells drilled on land can have a bad effect on the air, the water, and the land itself. Pollution of the land and nearby water can result from oil spills, "blowouts" (uncontrolled oil gushers), and salty waters that come from the well.

Risks connected with offshore wells include accidental spills and leaks from the oil source. Oil can kill ocean plants and animals, or it can spoil the flesh of fish and shellfish and make

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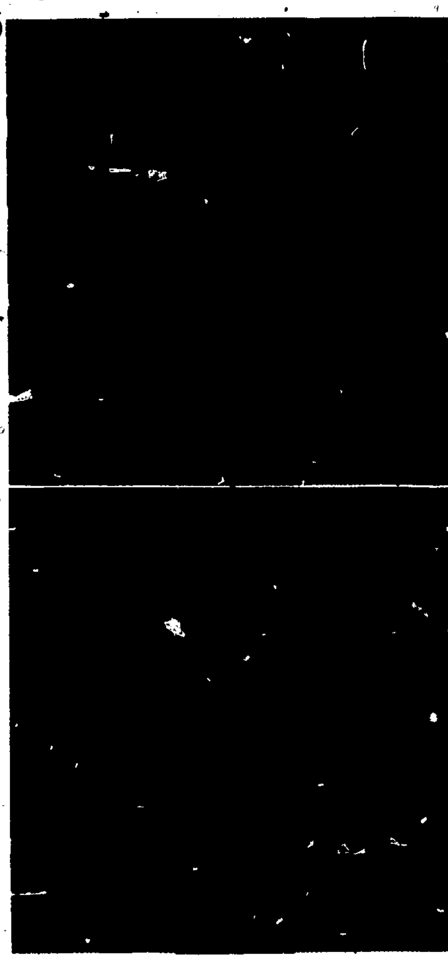
(c)



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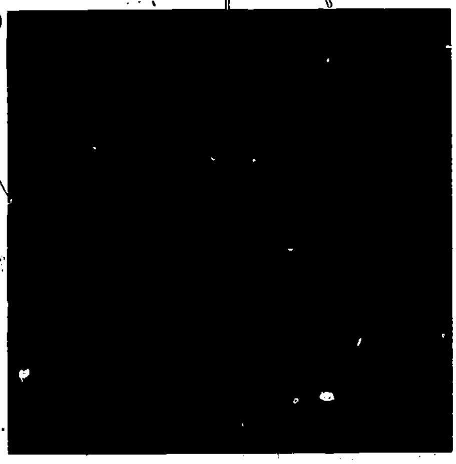


(a) **Old autos** can often be recycled as scrap metal.
(b) **Synthetic fibers** come from petroleum.
(c) **Newsprint to waste paper** only takes a few days, but it can also be recycled.

them unfit to eat. Many nations depend on food from the sea. In addition, massive offshore oil spills can pollute beaches and marshes, destroying recreational areas and wildlife nesting grounds.

We are all familiar with the "smoke" that is given off by burning coal, oil, or wood. This smoke is a kind of air pollution. Fewer homes today have coal furnaces than was true 20 years ago. Coal for home heating has been largely replaced by oil, electricity, and natural gas — partly because they are cleaner, and also because they are more convenient. But what this often means is that although less coal is burned to heat individual homes, great amounts must now be burned in powerplants to generate electricity.

Electric utilities in recent years have spent large sums of money to "clean up" the smoke caused by burning coal to produce electricity. Complex equipment can remove particles of "soot" as well as unhealthy gases that are given off by burning coal. However, cleaning up coal smoke is very expensive and, besides, small amounts of soot and gas can still escape up the stack and contribute to air pollution.

Not only does burning coal cause air pollution, but the process of extracting coal from the earth can cause water pollution and result in great damage to the land. During surface or strip mining, large areas of forested or fertile land may be destroyed to get at the coal lying underneath. And, in tunnel mines, underground water sources are disturbed, causing water to seep through the mines, picking up unwanted acids. This acid mine drainage pollutes the rivers, killing fish and water plants.

While nuclear power stations do not pollute the air, they do produce poisonous radioactive waste materials. This "atomic trash" will remain radioactive and highly dangerous for periods of 25,000 years or even longer. At present, there is no completely safe way to dispose of the radioactive waste from nuclear powerplants. Instead, the waste is placed in special containers and is "stored" on a permanent basis, guarded and watched over by the Federal Government. Although no serious pollution of the environment from reactor wastes has occurred, there have been spills and leakages of stored wastes. The problem of handling and storing nuclear wastes will get more serious as more electric power is generated from nuclear reactors and more wastes are produced.

Another form of pollution is from waste heat from powerplants. Too much heat introduced into a stream or river can kill fish and plants found there just as surely as acid mine drainage, untreated sewage, or chemical wastes. Electric powerplants, including coal-fired plants and those that use nuclear fuel, require large amounts of water for cooling purposes. Many utility companies have built "cooling towers" designed to release most of the heat from the cooling water into the air by evaporation. Water at lowered temperatures is then returned to the river, effectively reducing thermal pollution. But cooling towers are expensive and, in the case of plants situated in desert areas (some of the Western States), the water that is evaporated may be badly needed for irrigation.

Air and thermal pollution, acid mine drainage, and damaged landscapes — these are some of the costs of the energy we use. Expensive equipment can help reduce environmental harm — but there is another way, too. By using only the energy we really need we can help keep the environment clean and livable.

Energy Conservation Saves Money

Another very important reason for saving energy is the money you can save. Savings, of course, are important for yourself and your family. But savings in the amount you pay for energy will help your country as well.

During periods of inflation the costs

of almost all goods and services rise at an abnormal rate. Everyone finds that his dollars buy less — and this can mean serious hardship for many. Inflation is especially hard on people with lower incomes, and elderly people living on fixed incomes, such as Social Security.

One of the reasons for rising prices is an imbalance between the supply and demand for goods and services. When something is scarce and desired by many, prices tend to rise. By using less energy, we can make the supply of energy more nearly match the demand, and energy prices will tend to remain more stable. Thus, saving energy can help hold down inflation.

By using less energy you will also help hold down the amount of energy — mostly petroleum — that we must buy from other countries. You know that an individual cannot afford to spend more than he earns over a long period of time. The United States cannot, in the long run, afford to purchase more from foreign countries than we earn from the goods we sell abroad. By helping hold down the amount of energy we must import, you are helping us maintain a healthy balance in our trade with other nations.

A Project To Do: Energy Monitor

Here's a project which conserves fuel and saves your family money.

1. Find your gas or electric meter (or both). Make sure you know how to read them. (See project on Meter Reading in Chapter 1.)

2. Take a reading on Sunday evening, and compare it with the reading the following Sunday evening. How much energy did you use?

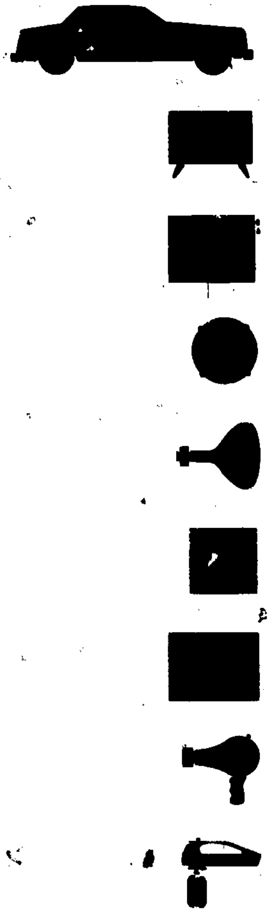
3. Make a list of everything in the house which uses that energy.

4. Now work out a plan with your family on how you can cut down on the use of that energy for 1 week. Write down your plan and try to get everyone to agree to follow it.

5. Again measure the amount of gas or electricity used over a week when your family was following your conservation plan. How much did you save? Could other factors such as cold or hot weather make a difference?

6. Compare your home's energy use with your friends. Why are there differences?

What uses the most energy?
(average annual use)



An automobile	900,000,000 BTU / yr.
A home heater	180,000,000 BTU / yr.
An air-conditioner	40,000,000 BTU / yr.
A stove	9,000,000 BTU / yr.
A color TV (tube)	9,000,000 BTU / yr.
A dishwasher	4,000,000 BTU / yr.
A black and white TV (solid-state)	2,000,000 BTU / yr.
A hair dryer	150,000 BTU / yr.
An egg beater	50,000 BTU / yr.

Uses of Energy

How Is Energy Used at Home?

A few basic facts show how important it is for Americans to save energy at home. Almost 20 percent of all the energy consumed in the United States is used in our 70 million households. That includes more than half of all fuels used for heating buildings and about a third of all the electricity.

More than half of the energy we use in our homes goes into heating and cooling. Heating water takes about 15 percent. Lighting, cooling, refrigeration, and operating appliances account for the rest. What appears to be small savings in the average household can add up to sizeable savings for the Nation if every family in the country takes part in the effort. In addition, every family that saves energy at home will be saving money.

Our home heating and air-conditioning systems use the greatest amount of energy of all. Therefore, they provide us with a real opportunity to save energy. When outside air leaks into your home in the winter, it adds to your heating bill. It also adds to your gas or electric bill in the summer if you have an air-conditioner. Winter or summer, it adds to your discomfort.

If someone punched a hole 6 inches long and 5 inches wide through the wall of your house in the middle of the winter, you would plug it up with anything you could find. If you didn't, you would have an opening of 30 square inches with the winter winds whistling through it day and night. A crack ⅛-inch wide around a normal-sized outside door has a total of almost 30 square inches, yet some homeowners ignore this waste. Our project will be to close as many air leaks as we can. Why throw away heat?

Projects To Do:

Caulking

Check all the outside doors of your home, including any door into an unheated attic or garage, to see whether there are cracks where a door frame meets the wall. Look along the edges of the frame, both inside and outside the house. For only a few dollars, your parents can get a caulking gun and a tube of white caulking at a hardware store. Fill any cracks with caulking on both sides of the door. Do the same for window frames.

Weather Stripping

There are various kinds of weather stripping you can use to seal the cracks around windows and around the top and sides of doors. There are other insulating devices that attach to the bottom of a door (called "door bottom" or "sweep") or to the threshold below the door. Some of these also keep out dust, light, noise and moisture as well as hot and cold drafts.

Some types of weather stripping come with adhesive backing; you peel the paper from the back and stick the strip to the door or window frame to fill the cracks. Other types can be installed with small nails.

You will need to look at the way your doors and windows are made before you decide what kind of weather stripping to use. You can get advice on what to use and how to apply it from your hardware dealer. Weather stripping packages also have instructions on how to apply the material.

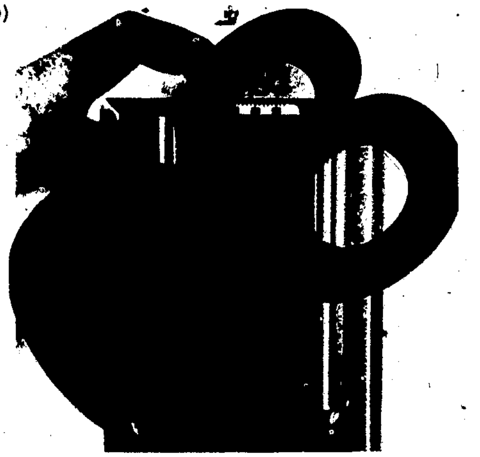
Weather stripping is not expensive, but it is effective and it quickly pays for itself in fuel savings.

Quick Check

After your caulking and weather stripping job, check for leaks. Cut a strip of plastic food-wrapping film about 8 inches long and 2 inches wide. Wrap one end tightly around a pencil, so that about 6 inches hang free. Using the pencil as a handle (hold it horizontally), pass the plastic film around the cracks of all doors and windows. Keep it about 2 inches away.

(a)

(b)



(c)

(a) **Drafty windows** waste energy.
(b) **Lower** thermostat to 68 degrees on winter days to save fuel.
(c) **Dripping hot water** wastes both water and energy.

If any air is coming in or going out through a crack, it will make the plastic ripple or wave. Wherever it waves, you still have an air leak.

Other Things To Do:

There are lots of other ways to conserve energy and save money around the house. Here's a quick checklist.

Check List

☐ Turn off all lights when not needed.

☐ In winter, turn down your thermostat to 68 degrees in the day and 60 degrees at night.

☐ In summer, make sure the air-conditioning thermostat is not lower than 78 degrees.

☐ Use draperies and shades wisely. In winter keep them open on sunny days, closed at night; in summer close them in daytime to deflect the sun.

☐ If your house doesn't have storm windows, an inexpensive substitute would be to tape a sheet of clear plastic to the inside of all window frames. This will provide an efficient barrier against the cold, and for about $7 you will reduce your fuel costs by about 15 percent, and make your home more comfortable, too.

ep a watch for dripping faucets. n how to replace the washers in your faucets. Your local hardware dealer can probably give you guidance.

☐ If you have a fireplace, look to see if the damper is closed. It should be open *only* when the fireplace is being used; otherwise, you will be wasting heat up the chimney.

☐ Don't let the hot water run while you are doing the dishes. If you have a dishwasher, make sure it's full before you run it.

How Is Energy Used in Town and City?

Energy is used in city living in many ways. Electricity, which is used to light streets and buildings, and sometimes cool or heat stores, is generated by burning oil or coal or natural gas, or in some places by using the energy stored in the atoms of uranium (nuclear) or the forces of running water (hydroelectric).

Most office buildings are heated with oil or natural gas. Gasoline and diesel oil move cars, trucks, buses, and many trains. Our factories get the power they need to manufacture their goods from coal, natural gas, or oil. Food, aluminum cans, and many products sold in shops require a great deal of energy to produce and transport. Others, especially plastics, are made from petroleum itself. The consumption of energy does not end when something is sold — we must also count the resources which are used up in disposing of our trash and refuse.

We Americans use a tremendous amount of energy — more per person than any country in the world. We have only 6 percent of the world's population, but we account for 35 percent of the world's energy consumption. Even countries with a standard of living about as high as ours (Germany, Denmark, and Sweden, for example) use about half as much energy per person as we do.

A Project To Do: Energy Survey

Much energy is wasted by our towns and cities. Shops may leave doors open when they are using energy to cool their buildings; office lights may be left on overnight; monuments may be flood-lighted; restaurants may be kept too cold with air-conditioning.

You can help your town or city by keeping a notebook of energy being wasted and the address of the place wasting it.

With your classmates list all the places you have all found wasting energy. After three or more class members have confirmed each energy waster on the list, have a class debate to decide if that use of energy is really wasteful.

After the debate and a class vote, write letters to the three addresses

How much energy Does each person use in a year?

An American
300 million BTU/year

A German
150 million BTU/year

A Russian
130 million BTU/year

A Puerto Rican
100 million BTU/year

A Chilean
40 million BTU/year

The World Average
35 million BTU/year

A Chinese
13 million BTU/year

An Indian
5 million BTU/year

A Nigerian
1.5 million BTU/year

A Nepalese
0.3 million BTU/year

considered to be wasting the most energy. Explain in your letter the national need to conserve energy, the class project you have undertaken, and the way you think energy is being wasted. Try to be helpful and suggest ways that the same job can be done with less energy.

Other Things To Do:

☐ Set up a display in the town hall or city library showing ways to save energy.

☐ Ask the local stores to give special price discounts on items that save energy. For example, sell 25-watt light bulbs for less than 100-watt light bulbs.

☐ Write an article for the local paper on the energy conservation project your class is doing.

☐ Interview everyone in your neighborhood to find the ways they are saving energy.

Energy in the Food Cycle

How Is Energy Used in Growing Things?

You eat food to give your body energy. Your body is like a complex chemical plant turning the chemical energy of food into the mechanical energy you use to run, walk, jump and play. You need the energy of a glass of milk to ride your bicycle for 20 minutes, or the energy of an apple to swim for 9 minutes. We measure electrical energy in "kilowatt-hours," but usually we measure food energy in "calories."

What did you have for breakfast this morning? If you had eggs and milk, they probably hadn't traveled far to your table. But everything else had been on a long trip: orange juice from Florida or California, grapefruit from Arizona, bacon from Nebraska, cereal from Kansas by way of Michigan or Minnesota, coffee from Colombia or Brazil.

To produce the food for our meal — any meal — requires energy . . . for planting and harvesting, fertilizer, machinery, irrigation, processing, packing (in paper, glass, steel, aluminum, or plastic), transportation, refrigeration, and cooking. Not much of that energy goes into your body, but it takes twice as much energy today, for the calories on your plate, as it did 15 years ago. And this is not including the use of the car to go to the supermarket to buy food and bring it home or the refrigerator you use for storage.

In simpler cultures, each calorie of energy invested in food produced 5 to 50 calories. Most of the energy in the food comes from the soil and the air. Some highly civilized societies have done as well. In sharp contrast, industrial food systems such as ours are almost reversed. It now takes 10 or 20 calories of energy to produce just 1 calorie of food energy.

One of our greatest challenges today is to find ways to stop starvation, feed the hungry, share our agricultural abundance with the less fortunate — and at the same time reduce the waste of both food and energy.

A Project To Do: A Compost Pile

Obviously, no one person can single-handedly alter the gigantic and complex industrialized food system. But there are things individuals can do which can help.

Put together a compost pile. This will recycle organic wastes and at the same time provide your garden with a constant supply of natural fertilizer.

You can save money in growing vegetables and flowers by making your own fertilizer. You can improve your environment by avoiding pollution from chemical fertilizers and you can save energy, since the production of artificial fertilizers takes great amounts of energy and chemicals made from petroleum.

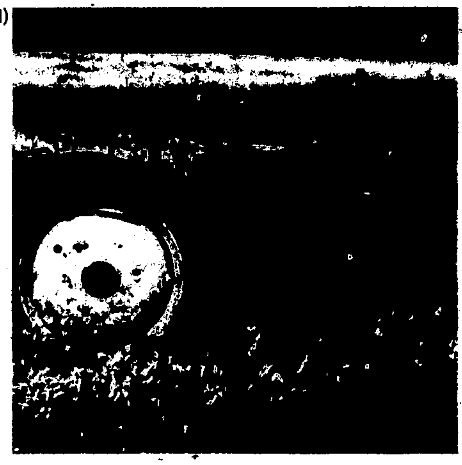
An outside compost pile is best and should be started in early autumn.

1. Select a shaded spot, if possible, to minimize evaporation. If digging is

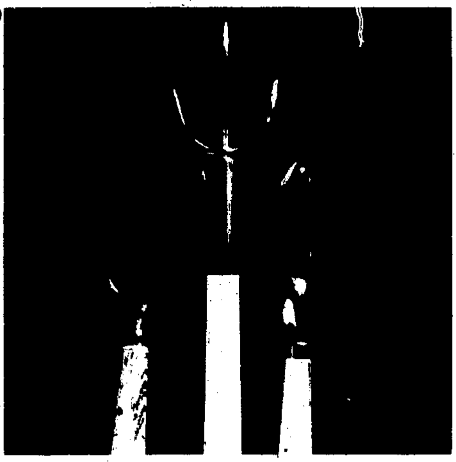
(a)

(c)

(d)



(b)



(a) **Food** provides energy for the body.
(b) **Victory gardens** help fight the energy shortage.
(c) **Irrigation** is necessary for agriculture in many areas.
(d) **Food production** requires vast amounts of fuel.

easy, go down as much as 2 or 3 feet. Keep the soil in a pile next to the compost; you'll need it. If the soil is rocky, use fencing or build a box above ground to keep the materials from getting scattered.

2. Mix different kinds of materials in layers — 5 or 6 inches of leaves, a thin layer of garden scraps and table scraps, a thin layer of dirt, a thin layer of grass clippings, and so on. Every time you add a layer, moisten with the hose (but do not soak). Add materials and dirt every day.

3. Every 6 or 7 weeks turn the pile with a pitchfork to mix up the materials. The purpose is to aerate, for air is necessary to help the compost materials to decompose (rot). Make sure that the materials which were on the outside wind up inside, where the heat of decomposition "cooks" the mass. Again, moistening with the hose (but not soaking) will help "cook" it.

How soon your compost pile will produce fertilizer depends on the type of materials, how well you have kept it up, and, of course, the weather. Although it will keep through the winter, try to set it up so that it has some time to get going before the snow sets in.

Other Things To Do:

☐ Start a Victory Garden. (A "Victory Garden" was what a vegetable garden was called in wartime, when growing your own food was a patriotic necessity. A victory over energy shortages is just as important as a victory in wartime.) If you have a garden, use natural manures as well as compost, and avoid chemical fertilizers if possible. Also rotate the crops and plant winter legumes, which fix nitrogen as a green manure.

☐ Use the rotary hoe twice in cultivation. Any and all these steps benefit the environment by not polluting; avoid the use of synthetic pesticides and fertilizers, which use petrochemicals in their manufacture, and save money. Why go out and buy synthetics when you throw away the natural thing?

☐ Use hand tools in the workshop and hand lawnmowers, pruners, and clippers in place of powered equipment in the yard and garden whenever possible.

☐ When using gasoline-powered yard equipment, do not allow it to idle for long periods. Turn it off when you are not using it, start it again when ready to resume work.

☐ Your refrigerator uses energy to store food. Keep count of the number of times the door is opened each day. See if you can reduce the number.

Energy in Transportation

How is Energy Used in Transportation?

Passenger automobiles consume about 14 percent of all the energy and about 31 percent of all the petroleum used in the United States.

Americans own over 100 million cars and drive each of them about 10,000 miles per year. Each automobile averages about 700 gallons of gasoline per year. Does that tell you how much gasoline we use in the United States? (Don't forget, these figures don't include trucks, boats, airplanes, or other gasoline engines!)

We waste gasoline (and money) by poor driving habits, poor car care and maintenance, and poor trip planning. If you have your driver's license, there is much you can do to help. Even the young person who doesn't drive can save gasoline by walking, riding a bike, and combining errands into fewer trips, rather than asking parents for a ride each time something comes up. If fuel consumption of the average car were reduced just 15 percent, the nation's consumption of petroleum would fall by over 28,000,000 gallons per day.

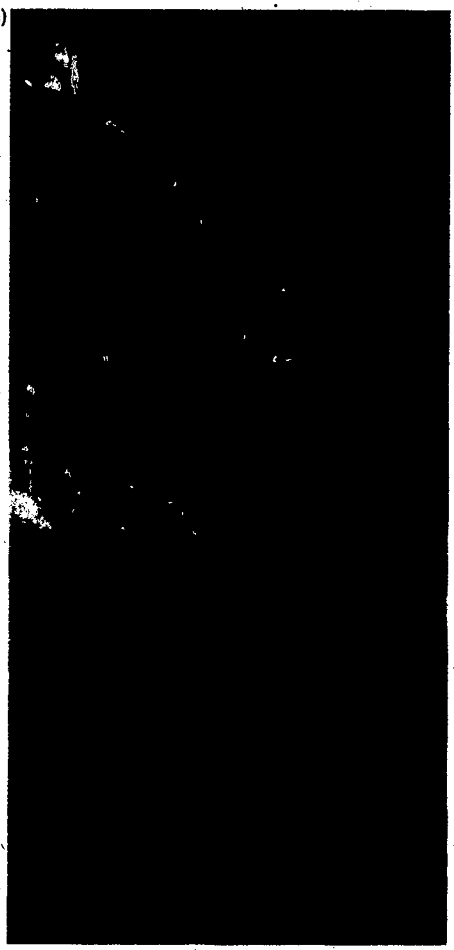
A Project to Do: Driving Record

To do this project, you will need to enlist the help of all the members of your family who drive. Make a chart for

(a)

(b)

(c)



(a) **Sailing** uses an inexhaustible form of energy.
(b) **Jogging** saves fuel and is good exercise.
(c) **Recreation** need not consume our precious energy resources.
(d) **Bicycles** conserve energy and avoid pollution.

each driver and keep a record of every trip for a week. If you have a driver's license, be sure to include yourself. Record the purpose and mileage of each trip. The charts might look something like this:

DRIVER

Date	Purpose	Miles
Sept. 4	To work & back	14
Sept. 5	To work & back	14
Sept. 6	To work & back	14
Sept. 7	To work & back	14

DRIVER

Date	Purpose	Miles
Sept. 4	Grocery store	4
Sept. 5	Little League practice	3
Sept. 6	Gas station	4
Sept. 7	Piano practice	6

DRIVER

Date	Purpose	Miles
Sept. 4	Movies	6
Sept. 5	Basketball practice	5
Sept. 6	None	0
Sept. 7	Grocery store	4

When the week is over, study the number of trips, their purpose and the total miles driven. Develop a plan with your family that will reduce the number of trips and the miles driven. Get each driver to agree to the plan.

Have each driver record all trips for 1 week, following your plan. Total the number of trips and miles driven. Now compare this with the previous week. How many miles and trips were saved? If your car averages 13 miles per gallon, how much gasoline did your plan save in 1 week? How much money? How much would it save in a year?

Other Things to Do:

☐ Walk, take the bus, or ride your bike when possible, rather than asking to be driven in the car.

☐ When you must go by auto, combine several errands in one trip.

☐ Alert the drivers in your family to ways they can save while driving (for example, smooth starts, moderate speeds).

☐ Help keep a check on miles per gallon for your family's car. (That's the number of miles you get from 1 gallon of gas.) Write down the amount of gasoline added to the tank at each fill-up and the odometer reading. The miles per gallon are obtained by dividing the miles driven since the previous fill-up by the gallons added at the last fill-up.

☐ Check tire pressure at least once a month. Tires which are low reduce fuel economy by as much as 1 mile per gallon.

Energy at School

How is Energy Used at School?

The sharp rise in fuel costs has put a special burden on school systems and other public institutions. When costs go up, a business can pass the cost rises along to the customer in the form of higher prices or rates. But when costs of necessary supplies such as energy rise for a public institution such as a school, which is on a fixed budget, it has to close down, lay off teachers, or otherwise find the additional money.

Some school administrators, governments, and private foundations saw this problem several years ago. And they are doing something about it: they are busily improving the operation and maintenance of school facilities. They are modernizing existing schools. And they are planning new, more efficient schools, with the latest energy-saving technologies built into them. And in a few enlightened communities, the school authorities are involving the students. Youth power can help, as shown below.

A Project to Do: School Study

Arrange to study the operation and maintenance of your school, and discuss possible improvements with the principal and the engineer-custodian. Is the furnace system operated at peak efficiency? At what

(d)

temperature is the thermostat for each room set? Are empty rooms heated or air-conditioned? How long has it been since the furnace was serviced? Does the air-circulating system get regular replacement of filters? How much of the total energy consumed is used between 4 p.m. and the next morning? (Read the school meters.) Is that when most of the custodians are at work? Do they shut off — indeed, can they shut off — the lights, heating, ventilating, and air-conditioning equipment in rooms as they finish their work? If not, could switches be installed, at low cost, which would enable them to do so? Could clean-up be done during the day without interfering with school work? Is natural light sufficient in the classrooms and hallways? If so, could the electric lights be dimmed?

Does the maintenance department own a light meter, and if not, shouldn't they buy one? Borrow a light meter and measure the light in each room. The Federal Energy Administration recommends lighting levels of 50 footcandles at desks, 30 footcandles in rooms and work areas, and 10 footcandles in nonworking areas such as halls and storerooms. Are the lights left burning all the time in the cafeteria and other spaces occupied only part of ... /?

... n also develop a plan for changes in the building which will conserve energy. Could the doors and windows be caulked to avoid heat loss? Could the attic have insulation added without major expense? Should plastic sheeting be placed over the windows to act as inexpensive storm windows?

Other Things to Do:

☐ Is there a safe bicycle rack at your school? Write a petition to the school board asking that one be installed.

☐ Organize an Energy Conservation Corps to bring together all the students interested in saving energy, and pool their ideas. Write the Energy Conservation Corps, c/o Bolton Institute, 1835 K Street, NW, Washington, D.C. 20006, for information and case histories of activities in other schools.

During the energy crisis of the winter of 1973-74, the school board in one town in New England considered closing the high school for a month to save 15,000 gallons of fuel oil. A physics teacher and his class organized an Energy Conservation Corps project which they called "Be Thrifty Using Fuel" (B.T.U.F.) and, with the aid of an electrical contractor, did a heat loss study of the school building. This study showed that it was unnecessary to close the school. In fact, by taking simple steps to eliminate wasted energy (such as turning down the thermostat and caulking the doors, for example), a great deal of fuel could be saved.

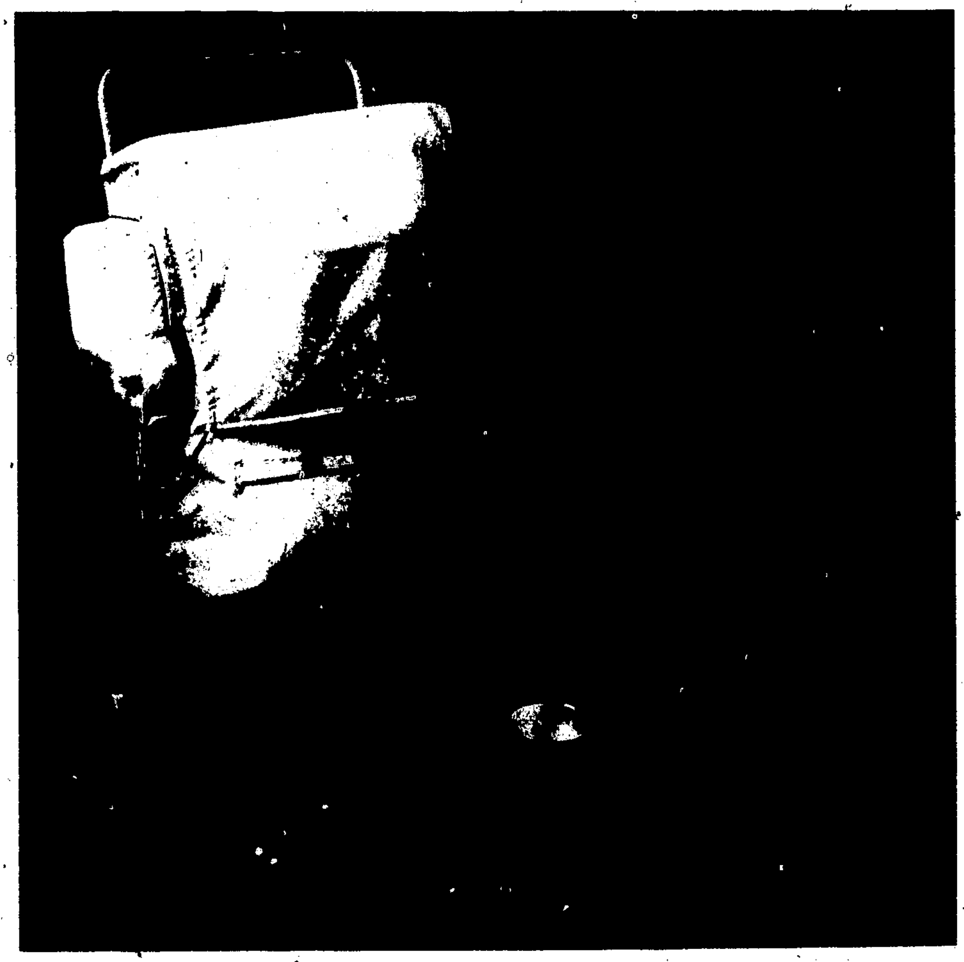
The school superintendent was so impressed by the study that he followed its recommendations. Instead of closing the school for a month to save some 15,000 gallons of fuel, the administration kept it open, using energy-saving methods, and saved 80,000 gallons. The B.T.U.F. team was invited by the superintendent to do similar studies of other existing school buildings and to make recommendations concerning proposed new school buildings.

All over New England, where the Energy Conservation Corps was started, other Energy Conservation Corps units are busy with practical projects. At one junior-senior high school, the students calculated that heat loss through the doors and windows cost $5,334 per year. Yet, for an investment of $300, they bought and installed all the caulking compound, weather stripping and plastic sheeting (in place of storm windows) needed to eliminate the heat loss.

Energy in Recreation

How is Energy Used in Recreation?

Even though you may think most of your time is spent in school, working



Hiking can actually waste fuel if we travel great distances to do it.

around the house, or asleep at night, you actually have about one-third of your time left for recreation. This amounts to almost 3,000 hours per year.

Outdoor or indoor sports, camping and hiking, arts and crafts, hobbies, amusements, and travel are probably among your interests. Each is desirable, and a good balance contributes to the health and happiness of the whole person. But one thing they all take is . . . energy! So long as it is only human energy, good. But some types of recreation use both human energy and natural energy resources, and you should think twice about them.

Some forms of recreation may not seem to use much fuel. For example, hiking or mountain climbing might seem to use little fuel. But some people fly or drive great distances to get to the mountain they wish to climb. In such cases, these sports would be "energy intensive," that is, they would use a large amount of fuel. Driving to the swimming pool, golf course, or tennis court every day all summer might be even more energy intensive.

In case of future energy shortages, you might have to cut down on some of your recreational activities. If you could not afford the electrical energy to operate your television set, could you find as much satisfaction in reading a book, playing a guitar, or just meditating? Could you get to know someone else better by taking a hike, playing ball, or throwing a frisbee?

How you use your leisure time is a personal matter and basically only you can decide if you wish to make any changes in your habits. You should, however, think about it, add up the amount of energy you probably consume in recreation, and think about whether you might enjoy more benefits, and use less fuel, by making some changes.

A Project to Do: Energy Impact Statement

A Federal law requires the Federal Government to do an environmental impact statement on any Federal action which has a significant impact on the human environment. Make up an energy impact analysis and statement for your recreation-leisure activities.

Other Things to Do:

☐Talk to your parents about a new kind of vacation this year. Rather than driving from one motel to another, find one place to spend the whole vacation. Ask a travel agent for ideas for resorts with tennis courts, back-packing, swimming, nature walks, and other energy-conserving activities.

☐Can you form a carpool for yourself and your friends when you must drive to your recreation? Try to avoid having several cars go to the same place when one will do.

☐Your bicycle doesn't use any fuel and is a very healthy form of exercise as well. Are there bike paths in your town, making it safer and more fun to ride your bicycle? You may be able to get free maps of bike paths in your community through your local highway office.

A Brief Glossary

BTU/The British thermal unit, the amount of energy needed to raise the temperature of 1 pound of water by 1 degree Fahrenheit.

Calorie/The amount of heat needed to raise the temperature of 1 gram of water 1 degree Centigrade. About as much heat as is given off by burning one wooden kitchen match.

Chemical Energy/Energy stored in molecules, as in fossil fuels.

Crude Oil/Petroleum in its natural state.

Electricity/Energy derived from electrons in motion.

Electron/An elementary particle, with a negative charge, which circles the nucleus of an atom.

Energy/The capacity to perform work or produce motion.

Fossil Fuels/Fuels derived from the fossil remains of organic materials; includes petroleum, natural gas, coal, oil shale, and tar sands.

Generator/A machine for changing mechanical energy into electrical energy.

Geothermal Energy/Heat energy within the earth's outer crust.

Hydropower/Energy in stored or ...g water.

Kinetic Energy/Energy possessed by objects in motion.

Motor/A machine that converts chemical or electrical energy into mechanical energy.

Nuclear Energy/Energy within the nucleus of the atom. It can be released by nuclear fission or nuclear fusion.

Potential Energy/Energy that is stored in matter because of its position or because of the arrangements of its parts. Examples include the tension of a spring, water stored behind a dam, or chemical energy such as that contained in fuel.

Power/The rate at which energy is used or generated. Power is commonly measured in units such as horsepower or kilowatts.

Solar Energy/Energy radiated directly from the sun.

Turbine/A motor which is driven by the pressure of water, air, or steam against the curved vanes of a wheel to transform heat, chemical energy, or water pressure into mechanical energy.

Energy Measurements

Barrel (bbl)/1 barrel equals 42 gallons.

British Thermal Unit (BTU)/The energy required to increase the temperature of 1 pound of water by 1 degree Fahrenheit.

Watt/The amount of power available from an electric current of 1 ampere (amp) at a potential of 1 volt.

Kilowatt (kW)/1,000 watts. One kilowatt is the equivalent of about 1⅓ horsepower.

Kilowatt-hour (kWh)/1,000 watt-hours. A unit of electrical energy equal to the energy delivered by the flow of 1 kilowatt of electrical power for 1 hour. (A 100-watt bulb burning for 10 hours will use 1 kilowatt-hour of energy, or enough to lift a 150 pound person 20,000 feet into the air.) One barrel of oil contains about 500 kWh of energy.

Megawatt (mW)/1 millon watts, or 1,000 kilowatts.

Thousand Cubic Feet (Mcf)/1,000 cubic feet (of natural gas).

Therm/A unit of heat equal to 100,000 BTU's.

Energy Units Translated into BTU's

1 kilowatt-hour	3,413 BTU's
1 ton of coal	25,000,000 BTU's
1 bbl crude oil	5,800,000 BTU's
1 gallon of gasoline	125,000 BTU's
1 gallon of No. 2 fuel oil	140,000 BTU's
1 cubic foot of natural gas	1,031 BTU's
1 Mcf natural gas	1,031,000 BTU's
1 therm of gas (or other fuel)	100,000 BTU's
1 cord of wood	20,000,000 BTU's

Things to Read

Alternative Energy, Mother Earth News #24, $1.50 (includes Alternative Energy poster), P.O. Box 38, Madison, Ohio 44057.

Alternate Sources of Energy: Equipment Directory — 4 issues, $5.00, Steve Coffel, Route 4, Box 90, Golden, Colorado 80401.

Citizen Action Guide to Energy Conservation, Citizen's Advisory Committee on Environmental Quality. $1.75 from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. (Stock No. 4000-00300. Discount of 25 percent on orders of 100 or more mailed to the same address.)

Coping With the Energy Crisis, Consumer Federation of America, Suite 901, 1012 12th Street, NW, Washington, D.C. 20005.

Energy and Ecology, Public Education Association, 20 West 40th Street, New York, New York 10018.

Energy, A Special 8-Page Report, National Wildlife Federation, 1412 16th Street, NW, Washington, D.C. 20036. (Single copies free.)

Energy Conservation Experiments You Can Do . . . from Edison, Thomas Alva Edison Foundation, Cambridge Office Plaza, Suite 143, 18280 West Ten Mile Road, Southfield, Michigan 48705. 35¢.

Energy: The New Era, S. David Freeman, Vintage Book, 1974. Paperback $2.45.

Food and Energy, Center for Science in the Public Interest, 1779 Church Street, NW, Washington, D.C. 20036. $4.00.

Gasoline: More Miles Per Gallon, 35¢, Stock No. 5000-00072, U.S. Government Printing Office, Washington, D.C. 20402.

Lifestyle Index, Center for Science in the Public Interest, 1779 Church Street, NW, Washington, D.C. 20036. $1.50.

Pedal Power: Courses for Action for Commuter Bike Routes, Bicycle Institute of America, 122 East 42d Street, New York, New York 10017. (Free).

Solar Heater, Mother Earth News #21, $1.35, P.O. Box 38, Madison, Ohio 44057.

The Contrasumers, Albert J. Fritsch, 1974. Praeger Paperbacks, $3.50.

Tips for Energy Savers, Federal Energy Administration, Washington, D.C. 20461. (Free).

Tips for the Motorist: 30 Good Ways to Make Gas Go Further, Federal Energy Administration, Washington, D.C. 20461. (Free).

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Helpful People

American Association for the
Advancement of Science
1515 Massachusetts Avenue, NW
Washington, D.C. 20005

American Conservation Association, Inc.
30 Rockefeller Plaza
New York, New York 10020

American Petroleum Institute
1801 K Street, NW
Washington, D.C. 20006

Center for Science in the Public Interest
1779 Church Street, NW
Washington, D.C. 20036

Cooperative Extension Service
County (Office usually at County Seat)
State (campus of land-grant university)

Energy Conservation Corps
c/o The Bolton Institute
1835 K Street, NW
Washington, D.C. 20006

Environmental Protection Agency
Public Information Center (PM 215)
Room 2106
Washington, D.C. 20460

Federal Energy Administration
Energy Conservation and Environment
Washington, D.C. 20461

Federal Energy Administration
Office of Communications and
Public Affairs
Washington, D.C. 20461

League of Women Voters
1730 M Street, NW
Washington, D.C. 20036

State Energy Office
c/of The Governor's Office
(your state capital)

Your local gas and electric companies.

The Conservation Foundation
1717 Massachusetts Avenue, NW
Washington, D.C. 20036

National Recreation and Park Association
1601 North Kent Street
Arlington, Virginia 22209

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Alternative Energy, Mother Earth News #24, $1.50 (includes Alternative Energy poster), P.O. Box 38, Madison, Ohio 44057.

Alternate Sources of Energy: Equipment Directory — 4 issues, $5.00, Steve Coffel, Route 4, Box 90, Golden, Colorado 80401.

Citizen Action Guide to Energy Conservation, Citizen's Advisory Committee on Environmental Quality, $1.75 from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. (Stock No. 4000-00300. Discount of 25 percent on orders of 100 or more mailed to the same address.)

Coping With the Energy Crisis, Consumer Federation of America, Suite 901, 1012 12th Street, NW, Washington, D.C. 20005.

Energy and Ecology, Public Education Association, 20 West 40th Street, New York, New York 10018.

Energy, A Special 8-Page Report, National Wildlife Federation, 1412 16th Street, NW, Washington, D.C. 20036. (Single copies free.)

Energy Conservation Experiments You Can Do . . . from Edison, Thomas Alva Edison Foundation, Cambridge Office Plaza, Suite 143, 18280 West Ten Mile Road, Southfield, Michigan 48705. 35¢.

Energy: The New Era, S. David Freeman, Vintage Book, 1974. Paperback $2.45.

Food and Energy, Center for Science in the Public Interest, 1779 Church Street, NW, Washington, D.C. 20036. $4.00.

Gasoline: More Miles Per Gallon, 35¢, Stock No. 5000-00072, U.S. Government Printing Office, Washington, D.C. 20402.

Lifestyle Index, Center for Science in the Public Interest, 1779 Church Street, NW, Washington, D.C. 20036. $1.50.

Pedal Power: Courses for Action for Commuter Bike Routes, Bicycle Institute of America, 122 East 42d Street, New York, New York 10017. (Free).

Solar Heater, Mother Earth News #21, $1.35, P.O. Box 38, Madison, Ohio 44057.

The Contrasumers, Albert J. Fritsch, 1974. Praeger Paperbacks, $3.50.

Tips for Energy Savers, Federal Energy Administration, Washington, D.C. 20461. (Free).

Tips for the Motorist: 30 Good Ways to Make Gas Go Further, Federal Energy Administration, Washington, D.C. 20461. (Free).

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Helpful People

American Association for the Advancement of Science
1515 Massachusetts Avenue, NW
Washington, D.C. 20005

American Conservation Association, Inc.
30 Rockefeller Plaza
New York, New York 10020

American Petroleum Institute
1801 K Street, NW
Washington, D.C. 20006

Center for Science in the Public Interest
1779 Church Street, NW
Washington, D.C. 20036

Cooperative Extension Service
County (Office usually at County Seat)
State (campus of land-grant university)

Energy Conservation Corps
c/o The Bolton Institute
1835 K Street, NW
Washington, D.C. 20006

Environmental Protection Agency
Public Information Center (PM 215)
Room 2106
Washington, D.C. 20460

Federal Energy Administration
Energy Conservation and Environment
Washington, D.C. 20461

Federal Energy Administration
Office of Communications and
Public Affairs
Washington, D.C. 20461

League of Women Voters
1730 M Street, NW
Washington, D.C. 20036

State Energy Office
c/o The Governor's Office
(your state capital)

Your local gas and electric companies.

The Conservation Foundation
1717 Massachusetts Avenue, NW
Washington, D.C. 20036

National Recreation and Park Association
1601 North Kent Street
Arlington, Virginia 22209