2

An Introduction to Energy

Basic Concepts

- Identify types of energy surrounding us.
- Differentiate among renewable, nonrenewable, and inexhaustible energy sources.
- Explain the difference between potential and kinetic energy.
- Name and describe the six forms of energy.

Intermediate Concepts

- Describe the history of energy consumption in the United States.
- Name various sectors of society associated with energy consumption.
- Summarize the present energy consumption trends in the United States and worldwide.
- Discuss the concept of efficiency.
- Define the law of entropy.

Advanced Concepts

- Recognize various factors that influence the exploration and development of different energy resources.
- Give examples of reasons for growth in the demand for energy and power.

Energy is the ability to do work. It is one of the driving forces behind a modern, technologically advanced economy. The study of energy is important because serious decisions about the development of energy resources and associated technologies will have to be made in your lifetime. Issues surrounding energy resources are often complex. In addition to technical factors, factors such as politics, economics, and environmental concerns must be considered when making decisions about the development and use of particular energy technologies.

GREEN TECH
Our use of different energy sources affects our environment. Using any energy source may either reduce the amount of the resource or produce by-products.

Energy: The Ability to Do Work

Often, we notice the work produced from energy and miss the energy being used. Work causes change. Wind that causes a windmill to operate a pump and pump water is an example of the effects of work. We often forget, however, that it is the energy produced by the wind that causes the work. Energy is at work all around us. The sun heats and lights the earth. See **Figure 2-1.** We, as humans, exert energy. Walking and bicycling are examples of work being done with the energy within us. See **Figure 2-2.** Energy affects our lives in many ways. It is easy to see some effects of energy. Still, we often fail to notice energy's many influences on our world. These influences range from impacts on our environment to economic and political considerations.

Figure 2-1. The sun provides the earth with huge amounts of energy.

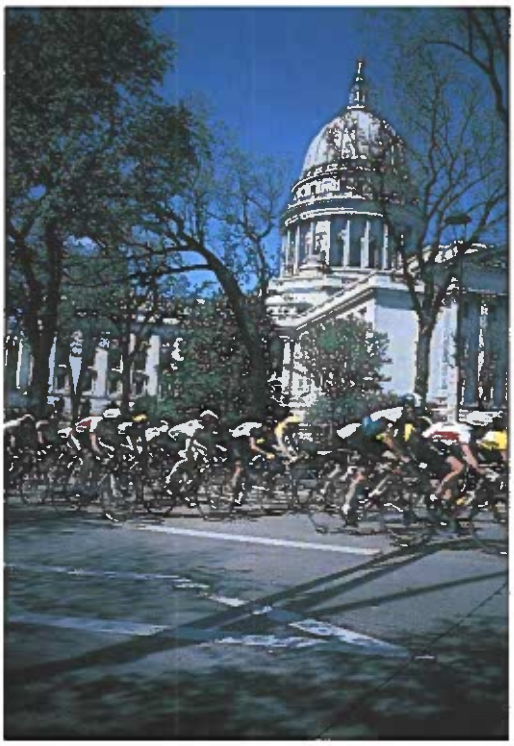


Figure 2-2. Human beings convert energy sources, such as food, into energy used in work and play. (Wisconsin Department of Tourism)

For instance, you can see the sunlight and feel the sun's heat. You can feel the wind. The effects of big gusts of wind and tornadoes can be seen. You can see an airplane as it soars through the air. It is harder, however, to see the effects of energy on plants, lakes, and forests within our environment. See **Figure 2-3.**

Renewable energy source: A resource that can be replaced when needed.

Energy is used in many ways around us, but what is its source? It comes from many sources. These sources can be organized into the following groups:

- Renewable energy resources.
- Nonrenewable energy resources.
- Inexhaustible energy resources.

Renewable energy sources are those resources that can be replaced when needed. Food is one example that supplies energy for humans. Wood, cornstalks, and sugarcane are all examples of fuel sources that can be harvested and regenerated in a relatively short period of time.

Nonrenewable energy sources are those that cannot be replaced once used. Fossil fuels, such as coal, oil, and natural gas, are good examples of nonrenewable energy sources. Since it takes hundreds of thousands of years to produce the natural resources that constitute fossil fuels, these sources are considered nonrenewable. Uranium, which is mined from the ground much like coal and used as fuel for nuclear power plants, is also considered a nonrenewable energy source.

Inexhaustible energy sources are those that will never run out. At least, they will last for the next several million years! The sun, the wind, and waves are the most obvious examples of inexhaustible energy sources. These different sources of energy will be discussed in much greater detail in the following chapters.

Figure 2-3. Acid rain has damaged forests in the northeastern United States and eastern Canada. This scientist is gathering samples in a Massachusetts wetland to monitor water acidity. (National Oceanic and Atmospheric Administration)

Types of Energy

You have just been introduced to the different groups of energy resources. All energy formed from these sources can be classified into two types. Energy is either in the form of potential energy or kinetic energy.

Nonrenewable energy source: A resource that cannot be replaced once used.

Inexhaustible energy source: An energy source that will never run out.

Potential energy: Energy waiting to happen.

Potential Energy

Potential energy is energy waiting to happen. For instance, a gallon of gasoline can produce a tremendous amount of mechanical power when properly consumed within an automobile engine. It is only potential energy, however, while waiting in a gas tank until it is burned to produce power. Similarly, water behind a hydroelectric dam is only potential energy until it is used to spin a turbine for producing electricity. It then becomes kinetic energy.

Career Connection

Geologists

Science, Technology, Engineering & Mathematics

A geologist uses scientific methods to study the earth's materials and their relationships to one another and our world. An understanding of the world's natural history and resources is an important tool in this profession. This information is needed for future planning.

In many cases, a geologist spends most of his time doing research. This work helps to gather environmental data, and it is also beneficial for predicting natural disasters. A geologist communicates her research to others in the field either with technical papers or with demonstrations using drafting software.

A geologist must be skilled in several areas, including math and science. Geologists must also have good observational skills. Verbal and written communication skills are necessary to convey data and findings. A master's degree is typical for workers in this field. The yearly salary may range from $42,000 to $63,000.

Kinetic energy: Energy in motion.

Light energy: Energy visible to the eye.

Heat energy: Energy with a longer wavelength than light energy. It is generally not visible to the eye, but it can be measured in terms of temperature. Also referred to as *infrared energy.*

Mechanical energy: Energy produced by mechanical devices, such as gears, pulleys, levers, or more complex devices, such as internal combustion engines.

Chemical energy: The potential energy locked within a substance.

Kinetic Energy

Kinetic energy is often defined as energy in motion. The water that spins a turbine in a hydroelectric plant to produce electricity is an example of kinetic energy. The wind that can power a windmill or wind generator and the radiant energy from the sun are also examples of kinetic energy.

Forms of Energy

As we just discussed, energy is either potential or kinetic. Potential energy and kinetic energy are related to the form in which the energy is found. All the energy around us comes in different forms. These forms are as follows:

- ***Light energy*** is energy visible to the eye. It represents a very small portion of all radiant energy, which collectively is known as the electromagnetic spectrum.
- ***Heat energy***, also referred to as *infrared energy*, has a longer wavelength than light energy. This longer wavelength does not allow heat to pass through certain materials, like glass, as readily as light does. Heat energy is generally not visible to the eye, but it can be measured in terms of temperature.
- ***Mechanical energy*** is energy produced by mechanical devices, such as gears, pulleys, levers, or more complex devices, like internal combustion engines.
- ***Chemical energy*** is the term used to describe the potential energy locked within a substance. For instance, 50 lbs. of red oak might be capable of producing the same amount of heat energy as 15 lbs. of high-grade coal or 1 gallon of refined heating oil.
- ***Electrical energy*** is the energy associated with the flow of electrons. Electricity is used extensively in contemporary society to power the majority of our convenience appliances.

- ***Nuclear energy*** is the term associated with the power of the atom. It was initially harnessed during the 1940s. The initial use of nuclear energy was for war, but with the conclusion of World War II, peacetime uses for nuclear energy, such as power generation, emerged.

All six of these forms of energy are used to aid us in our everyday lives. They are used to do work for us. These forms of energy will be discussed in more detail in other chapters.

Electrical energy: The energy associated with the flow of electrons.

Nuclear energy: The power of the atom.

Measuring Energy

The most basic unit of heat energy is known as the ***British thermal unit (Btu)***. The Btu is a very small amount of energy. It is often compared to the amount of energy given off by one wood-stem kitchen match, if the match is burned completely. The Btu is an often-referenced energy unit because all forms of energy can be related to the amount of Btu they can produce. **Figure 2-4** shows how much energy it would take to produce 100,000 Btu with the use of various energy sources. Since the Btu represents such a small amount of energy, the term *heating unit* is often used when discussing energy for structural heating. One ***heating unit*** is equivalent to 100,000 Btu.

British thermal unit (Btu): The most basic unit of heat energy. The Btu is a very small amount of energy. It is often compared to the amount of energy given off by one wood-stem kitchen match, if the match is burned completely.

Heating unit: The equivalent of 100,000 Btu.

When measuring the ***energy consumption***, or use of energy resources, of a large city, country, or continent, a term known as the *quad* is often used. A ***quad*** is an accepted abbreviation for 1 quadrillion Btu. (One quadrillion is a one followed by fifteen zeros.) Homes and communities do not consume entire quads of energy, making the term a more conceptual reference point for extremely large-scale energy consumption. **Figure 2-5**

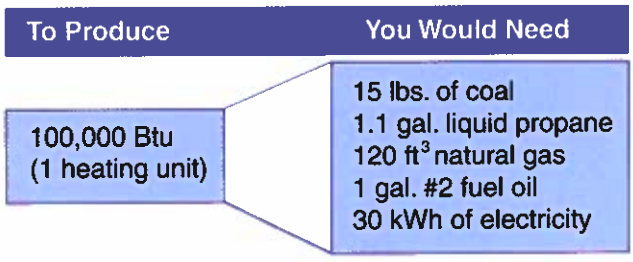


Figure 2-4. Quantity of fuel necessary to produce 1 heating unit (100,000 Btu).

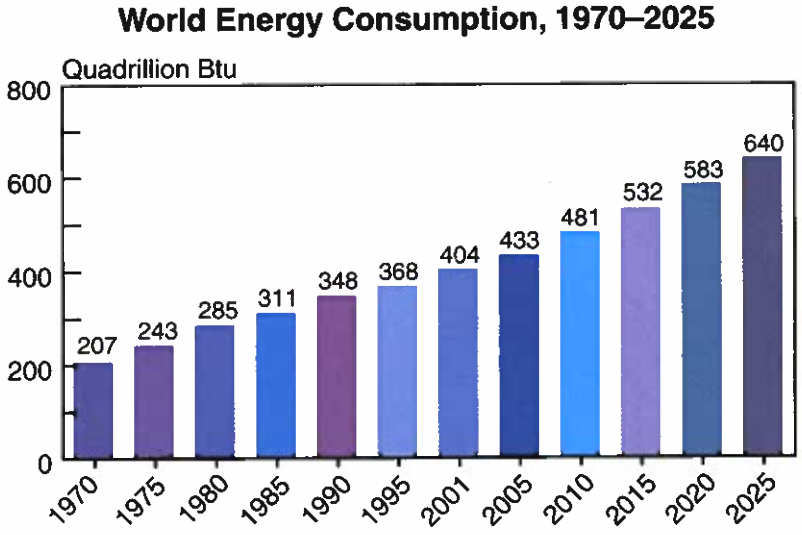


Figure 2-5. Actual and projected world energy consumption from 1970 to 2025, expressed in quadrillions of British thermal units (Btu). (U.S. Energy Information Administration)

Energy consumption: The use of energy resources.

shows the calculated and projected world energy consumption from 1970–2025, expressed in quads.

A Brief History of Energy Consumption in the United States

Energy sources in early America primarily consisted of wind, water, and wood. Factories were constructed near waterways to make use of flowing water by converting it to mechanical power with the use of a waterwheel. Farmers made use of the wind to create mechanical power for grinding flour and pumping water. Wood was burned as a source of heat.

By the 1800s, technology was demanding the use of a better heat source. The development of the steam engine led to the steam locomotive and the steamship. Coal replaced wood as the main energy source. Approximately the same amount of energy is produced by 15 lbs. of coal and 20–50 lbs. of wood. It is easy to see why coal would have been necessary to power a large steam engine, such as that of a steam locomotive or ship.

GREEN TECH
Throughout the years, people have been finding more efficient energy sources. Today, the focus is on utilizing our inexhaustible energy sources.

The internal combustion engine had been perfected by 1900, to the point that it was being used to power the first automobiles. See **Figure 2-6.** Americans soon began to depend on their cars. Pound for pound, gasoline contains much more energy than coal.

Figure 2-6. The introduction of the automobile in the early 1900s began the shift from coal to petroleum as the primary energy source. (Ford Motor Company)

There have been times when the supply of energy has not met the demand. In 1960, a group of nations committed to the strength and success of the oil market formed the ***Organization of Petroleum Exporting Countries (OPEC)***. The members of the OPEC decided to restrict the amount of crude oil they would sell to the United States, as a means of penalizing Americans for consuming too much energy. This type of restriction of trade for political means is known as an ***embargo***. The resulting effects of the embargo were devastating to the American economy. One way America responded to these crises was to produce smaller four-cylinder cars that offered better gas mileage than the larger engines popular in the 1960s and 1970s. Another response was an increased emphasis on ***energy conservation***, which involves making better use of the available supplies of energy.

Quad: An accepted abbreviation for 1 quadrillion Btu.

Organization of Petroleum Exporting Countries (OPEC): A group of nations committed to the strength and success of the oil market.

Embargo: Restriction of trade for political means.

Energy conservation: Making better use of the available supplies of energy.

By the early 1980s, America had begun to shift emphasis from an industrial society to a service society. Industries heavily dependent on energy, such as the steel industry, had begun to leave the United States. New jobs were formed in the service sectors of the economy, and the development of the personal computer ushered the nation into what many have termed the *information age*. Many start-up companies that focused on alternative energies, such as those that installed wind turbines and solar collectors, were eliminated.

It is important to recognize that the majority of all energy consumed in the United States is consumed in the industrial and transportation sectors of our economy. See **Figure 2-7.** Although alternative energy sources are expected to play a greater role in the world energy mix in coming decades, fossil fuels are anticipated to remain the dominant sources of energy for the foreseeable future. See **Figure 2-8.** World energy consumption on the whole is also expected to rise sharply in the future. The Energy Information Administration of the U.S. Department of Energy (DOE) estimates that world energy consumption will increase by over 50% by 2025.

As a society advances, so does its producing capability. Likewise, its energy consumption advances. The vast majority of all energy consumed in America and worldwide comes from fossil fuels. Although fossil fuels are nonrenewable, polluting, and sometimes economically volatile, we use far more fossil fuels to create power than other more environmentally friendly forms of energy. Fossil fuels simply yield more energy per volume than many other forms of energy. The use of fossil fuels is responsible for the creation of millions of jobs. It also helps the United States engage in a world economy.

Figure 2-7. Together, the industrial and transportation sectors account for 60% of the total energy consumption in the United States. (U.S. Energy Information Administration)

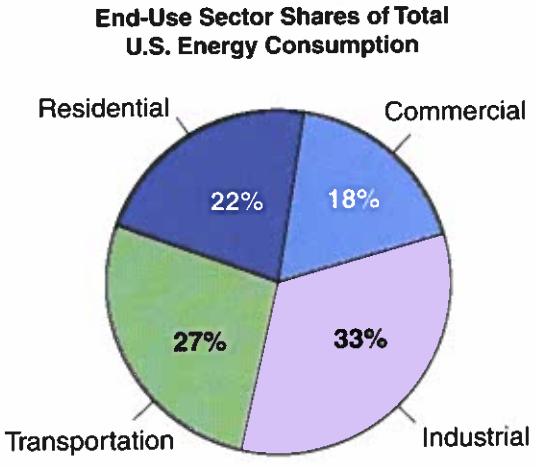
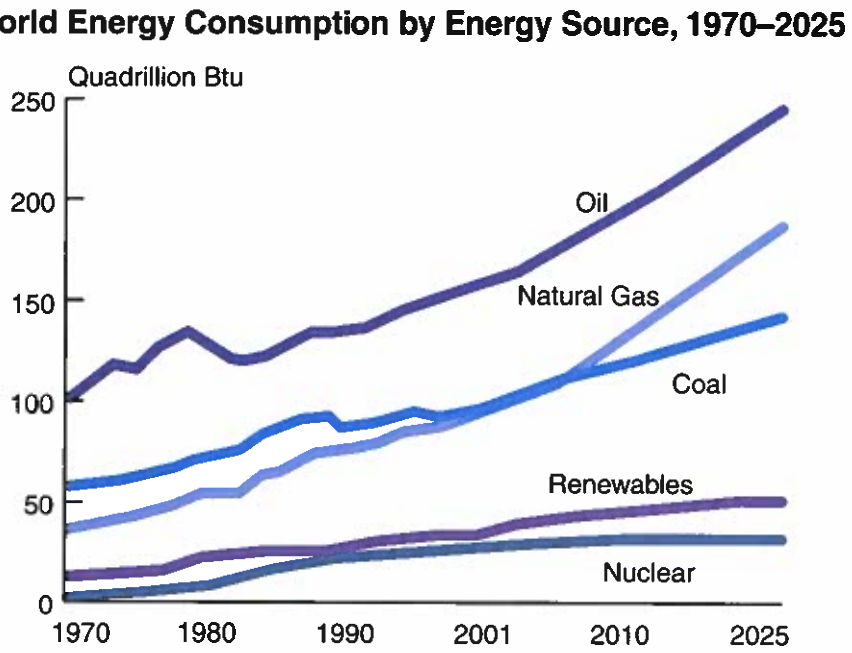


Figure 2-8. World energy consumption is projected to rise in every category except nuclear energy through 2025. (U.S. Energy Information Administration)



Energy Conversion

Energy conversion: The changing of one form of energy into another.

Technological advances, such as the development of the electric motor, the home heating furnace, and solar collectors, allow for energy conversion. ***Energy conversion*** is the changing of one form of energy into another. For example, an electric motor converts electrical energy to mechanical energy. A furnace converts a potential energy source, like heating oil or natural gas, into a kinetic energy source in the form of heat. A solar collector converts sunlight to heat.

Efficiency: The extent to which an energy form is usefully converted into another form of energy.

Efficiency is a term used to measure the extent to which an energy form is usefully converted to another form of energy. For instance, for many years, the internal combustion engine could only convert about 27% of the gasoline consumed into useful mechanical energy. Technological advancements over the past 30 years, however, have led to computer-controlled ignition, precise fuel injection, spark plug improvements, and more efficient engine designs. All of these factors translate to greater engine efficiency, which is now above 30% for many automobile engines. Improving the efficiency of energy conversion devices, such as engines, furnaces, and generators, is one of the primary ways to improve energy, power, and transportation technologies.

Some conversion devices, such as some home heating furnaces, have efficiency ratings in the 90% range. This means that, out of all the possible Btu contained in a gallon of heating oil, 90% or more are converted into heat. Other conversion devices, such as the internal combustion engine, are nowhere near as efficient. One reason is the law of entropy. ***Entropy*** is a measure of the unavailable energy in a closed system. The law of entropy states that whenever an energy form is converted from one form to another, some loss will occur. **Figure 2-9** shows the approximate efficiencies for various conversion devices.

Entropy: A measure of the unavailable energy in a closed system.

Figure 2-9. Energy efficiencies for common converters.

Conversion Efficiency		
Converter	**Conversion Efficiency (%)**	**Conversion Type**
Electrical Generator	95	Mechanical to Electrical
Large Electric Motor	90	Electrical to Mechanical
Dry Cell Battery	85	Chemical to Electrical
Home Gas Furnace	85	Chemical to Thermal
Starter Motor	85	Electrical to Mechanical
Storage Battery	85	Electrical to Chemical
Home Oil Furnace	65	Chemical to Thermal
Small Electric Motor	65	Electrical to Mechanical
Liquid Fuel Rocket	63	Thermal to Mechanical
Steam Turbine	45	Thermal to Mechanical
Steam Power Plant	30–45	Chemical to Thermal
Diesel Engine	30–40	Thermal to Mechanical
Industrial Gas Turbine	30	Thermal to Mechanical
High-Intensity Lamp	25–30	Electrical to Radiant
Automobile Engine	25	Thermal to Mechanical
Fluorescent Lamp	20	Electrical to Radiant
Wankel Engine	18	Thermal to Mechanical
Solar Cell	15–20	Radiant to Electrical
Thermocouple	5	Thermal to Electrical
Incandescent Lamp	5	Electrical to Radiant

STEM Connection

Math: Efficiency

Efficiency is a measurement of input to output. It is calculated as follows:

$$\frac{\text{output}}{\text{input}} \times 100 = \%\ \text{efficiency}$$

When discussing energy, efficiency measures the extent to which an energy form is usefully converted to another form of energy.

A furnace for a building consumes oil at 1.5 gal/hr. At this rate, the potential energy of the oil is 150,000 Btu/hr. The furnace produces, however, only about 130,000 Btu/hr because it is not completely efficient. What is the efficiency of the furnace?

To solve this problem, we use the efficiency formula. The following calculation tells us the efficiency of the furnace:

$$\frac{130{,}000\ \text{Btu/hr}}{150{,}000\ \text{Btu/hr}} \times 100 = 87\%\ \text{efficiency}$$

This means about 87% of the fuel consumed by the furnace is being converted into usable heat.

Acid rain: Rain contaminated by the by-products of combustion, such as carbon dioxide (CO_2), nitrous oxides (NO_x), and sulfur oxides (SO_x), which condense in our atmosphere.

Greenhouse effect: The situation caused by a layer of greenhouse gases surrounding our planet, produced by the burning of fossil fuels. This layer does not allow the heat produced by the sun to escape the earth's atmosphere as easily as it once did.

Energy and the Environment

The consumption of fossil fuels leads to environmental problems, such as acid rain and the greenhouse effect. ***Acid rain*** occurs when by-products of combustion, such as carbon dioxide (CO_2), nitrous oxides (NO_x), and sulfur oxides (SO_x), condense in our atmosphere, only to come back down to earth with rain. The effects of acid rain can be devastating to forests, ponds, and lakes, killing fish and altering entire ecosystems. Canada has been at frequent odds with the United States over acid rain that is created in the United States but drifts over the boundary water of Canada, polluting Canadian waters.

The ***greenhouse effect*** is said to occur because of gases produced by the burning of fossil fuels as well. When sunlight strikes the earth, a portion is reradiated back off the earth and into the atmosphere. The layer of greenhouse gases surrounding our planet is not allowing the heat produced by the sun to escape the earth's atmosphere as easily as it once did. The net result is that a partial trap occurs. This leads to a phenomenon known as ***global warming***. The effects of global warming are not widely understood, but at a minimum, global warming could cause the melting of ice caps, which could alter shorelines, and the changing of weather patterns, which could alter agricultural productivity.

Problems such as acid rain and the greenhouse effect are expected to increase. Developing nations are expected to consume more fuel to develop their economies. As the use of fossil fuels increases, so do harmful emissions.

Technology Link

Agriculture: Biodiesel

Are you looking for a clean-burning alternative fuel produced from domestic resources? Biodiesel contains no petroleum, but it can be blended with conventional diesel fuel to create a biodiesel blend that can be used in diesel engines without any major modifications. The fuel itself is created from fatty acids common in vegetable oils or animal fats. Such waste oil, a by-product of cooking, is routinely collected at restaurants. Restaurants usually give the oil away, as disposal is a nuisance. If biodiesel becomes popular, however, this could change.

Biodiesel can be used directly as a fuel, but it is often mixed with diesel fuel. This mix creates by-products that are considerably healthier for the environment than those created when pure diesel fuel is burned. The biodiesel actually reduces the amount of unburned hydrocarbons and nitrogen oxides released into the air during engine exhaust. It also virtually eliminates sulfur oxides and sulfates common in acid rain. In fact, biodiesel is the only alternative fuel to have successfully met the testing requirements established for health effects in the Clean Air Act. Now for the best part—fuel economy, horsepower (hp), and torque do not suffer when using biodiesel or a biodiesel blend.

This type of fuel is hardly a new invention. Most people do not know that the original diesel engine, as patented by Rudolph Diesel in 1893, was designed to run on peanut oil! Only the discovery of inexpensive crude oil put biodiesel on the shelf at that time. Now, as gasoline prices have risen dramatically, the country may need to take a serious look at alternative fuels and methods of easing our dependency on foreign oil. Biodiesel may enjoy a newfound resurgence. Your car might someday be powered by the waste oil from last week's breakfast!

Fighting Back: Conservation and Recycling

Recycling saves money, and it also saves energy. In fact, one of the reasons recycling works from a financial standpoint is precisely because of the energy saved to produce a recycled product. Consider these facts about recycling:

- Aluminum can recycling helps to save 95% of the energy required to produce new aluminum products.
- Recycling one plastic bottle can save enough energy to light a 60-watt bulb for 6 hours.
- If your school recycles 1 ton of paper this year, it will save the following:
  - 6953 gallons of water
  - 463 gallons of oil
  - 587 lbs. of air pollution
  - 4077 kilowatt-hours (kWh) of electricity
- Every day, Americans buy 62 million newspapers and throw out 44 million. This is the equivalent of dumping 500,000 trees into a landfill every week.
- Reducing your home's waste newsprint, cardboard, glass, and metal can reduce CO_2 emissions by 850 lbs. per year.

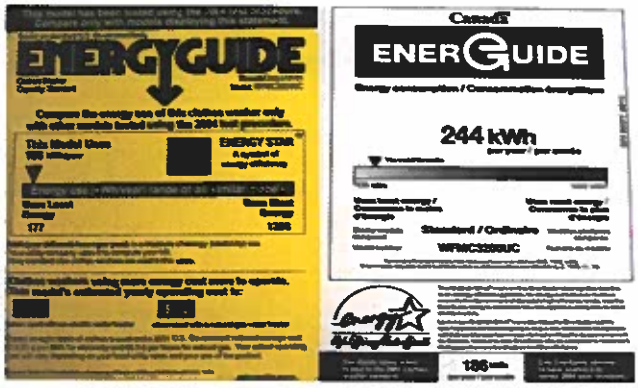
Recycling is one of the best ways to conserve energy, as the energy to create new paper, plastic, or glass bottles out of recycled materials is far less than what it takes using new raw materials. See **Figure 2-10.**

Global warming: An increase in the average temperature of the earth's atmosphere, possibly resulting in the melting of ice caps, which could alter shorelines, and the changing of weather patterns, which could alter agricultural productivity.

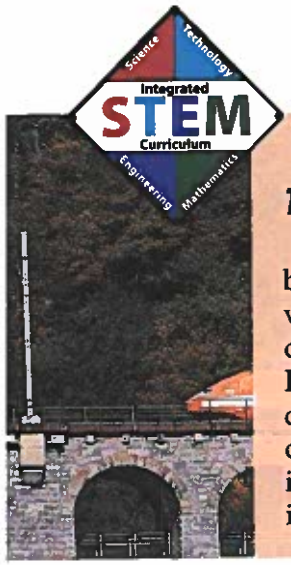
GREEN TECH
Another popular way of conserving energy is to switch to energy-saving bulbs. Incandescent bulbs are not as efficient as compact fluorescent lamps (CFLs).

Figure 2-10. A scientist at Argonne National Laboratory trains interns in methods of characterizing and segregating materials in the solid waste stream. They will put their training to use in setting up a community recycling project. (U.S. Department of Energy)

Figure 2-11. An energy guide is provided on new appliances to help consumers identify the most energy-efficient equipment. This clothes washer has guides for both the United States and Canada.



Another popular means of saving energy is through conservation measures. For instance, does anyone in your house turn the thermostat down at night, or do you leave it at the same temperature throughout the night, even though everyone is sleeping? Reducing the heat during the night is one simple means of conserving energy. Another is to shop for energy-efficient appliances. **Figure 2-11** shows an energy guide for a new appliance. The guide will indicate the estimated energy consumption for this particular appliance, in comparison to similar appliances by other manufacturers. More efficient appliances earn higher ratings.



STEM Connection

Technology: Infiltration

Infiltration is the term used to describe cold air forcing its way into a home or other building during the heating season through cracks and other openings, such as exhaust vents, chimneys, and cracks around exterior doors and windows. Hot air can also infiltrate during the air conditioning season. Excessive infiltration wastes heating or cooling energy. It also drives up energy costs for the building owner. As a building ages, it tends to settle, creating gaps and cracks that allow outside air to infiltrate the structure. Additionally, older buildings usually have doors and windows that are not as efficient at preventing infiltration as modern doors and windows, which typically seal extremely well. Reducing infiltration is an important part of energy conservation.

Career Skills

Career Planning

Career clusters are groups of occupations or career specialties that are similar or related to one another. The occupations within a cluster require a set of common knowledge and skills for career success. These are called essential knowledge and skills.

The 16 clusters were developed by state partnerships among educators, employers, and professional groups. The purpose of the clusters is to prepare students to transition from school to a rewarding career in an era of changing workplace demands.

If one or two job titles in a career cluster appeal to you, it is likely that others will, too. This is because the jobs grouped together share certain similarities. To help you narrow down your options, each career cluster is further divided into career pathways. These subgroups often require additional and more specialized knowledge and skills.

Knowing the relationship between careers in a given pathway is helpful when researching information about careers. The skills required for different jobs in a similar field may overlap somewhat. Preparing for more than one career in a related field allows more flexibility when you are searching for employment. If you cannot find the exact position you desire, your skills will be needed by other occupations in the same pathway. The more you learn about related careers now, the more easily you will be able to adapt to changes in your occupation later.

For more information on career clusters, see www.careerclusters.org.

Summary

Energy is the ability to do work. It is important to study because it affects our lives in so many ways. Energy affects our ability to function in a technological world. Many sources of energy come from the natural forces within our world. The sun, wind, and water are examples of inexhaustible energy sources. Other energy sources are renewable or nonrenewable. Energy is classified as potential or kinetic energy. Potential energy is at rest, and kinetic energy is in motion. There are six different forms of energy. They are heat, light, mechanical, chemical, electrical, and nuclear.

Most of the energy consumed in the world today is in the form of fossil fuels. These fossil fuels provide good energy content, or Btu, per volume, making them desirable for use. They are also responsible, however, for environmental destruction, including the production of greenhouse effect gases and pollutants that form acid rain. Additionally, there are political implications to using fossil fuels, since some of them are imported from other countries. At present, no one form of energy can solve all our energy needs. Fossil fuels and alternatives all offer inherent advantages and disadvantages. Converting energy from one form to another—for example, light to heat or heat to mechanical—will result in some loss, due to entropy.

It is important to understand energy and where it comes from. A knowledge of energy helps us understand energy, power, and transportation systems. Energy is the backbone of all power and transportation systems.

Key Words

All the following words have been used in this chapter. Do you know their meanings?

acid rain
British thermal unit (Btu)
chemical energy
efficiency
electrical energy
embargo
energy conservation
energy consumption
energy conversion
entropy
global warming
greenhouse effect
heat energy
heating unit
inexhaustible energy source
kinetic energy
light energy
mechanical energy
nonrenewable energy source
nuclear energy
Organization of Petroleum Exporting Countries (OPEC)
potential energy
quad
renewable energy source

Test Your Knowledge

Write your answers on a separate sheet of paper. Do not write in this book.

1. Define *energy*.
2. List some ways in which energy affects your life.
3. What are the differences among renewable, nonrenewable, and inexhaustible resources?
4. *True or False?* Energy waiting to happen is known as potential energy.
5. List the six forms of energy.
6. *True or False?* A quad is a means of measuring how much energy you consume in your home every month.
7. Name three sources of energy.
8. Why has the demand for energy and power grown throughout history?
9. In three sentences, discuss the history of energy consumption in the United States.
10. Explain what an embargo is.
11. Which two sectors of the economy are responsible for consuming the most energy?
12. *True or False?* The majority of all energy consumed in America and worldwide is in the form of fossil fuels.
13. Why are alternative energy sources, like wind generators, not more popular?
14. Summarize the concept of efficiency.
15. *True or False?* When energy is converted from one form to another, some loss will occur.

STEM Activities

1. Build and demonstrate a device that changes a renewable source of energy into a form that will do work.
2. Collect pictures from old magazines showing examples of potential energy in the world around you.
3. Construct a device that demonstrates potential energy being converted into kinetic energy.
4. Start a new recycling program in your school as a means of saving energy.
5. Brainstorm about the advantages and disadvantages of various conventional and alternative energy sources.

Career Skills

Finding a Job

When you are ready to find employment, you can get job leads through a variety of sources. Start your search at the placement office of your school. Usually school counselors and teachers can direct you to helpful job information. You can check newspaper want ads and job fairs. Good information is also available in libraries. The professional journals in your career field and the leading professional organizations often announce job openings. Family members and neighbors can provide help, too.

Today, one of the best ways to find jobs is using the Internet. You can search for open positions, and many sites also offer tips for job hunting. You can start at the U.S. Department of Labor's Web site. You can also explore the following helpful sources:

- The *Occupational Outlook Handbook* describes the major U.S. jobs and their working conditions, requirements, average salaries, and future outlook. This publication is available in most libraries and on the Internet.
- The *O*NET (the Occupational Information Network)* Web site is replacing the *Dictionary of Occupational Titles* and is the most complete online resource available. It provides tools for exploring careers, examining job trends, and assessing personal abilities and interests. It also includes options for finding jobs within a career cluster or searching for jobs related to specific skills.
- The *CareerOneStop* Web site has components for exploring careers, salaries, benefits, education, training, and other resources.

One part of CareerOneStop is *America's Career InfoNet*. You can use this site for exploring careers, including occupational trends, wage information, and state resources.

America's Service Locator is another component of CareerOneStop. This site helps users find jobs and job-related resources in their local area. These resources include One-Stop Career Centers, which offer assistance in job-seeking skills, such as résumé writing. They also offer help with various types of job training.

Many people find employment through networking. Networking is the exchange of information or services among individuals or groups. As a newcomer to the career field, the goal of your networking is to learn about possible job leads.

Social networking sites have become popular places to find information on companies and their available positions. Many companies network on these sites because it is an additional source of advertising for them. Users find that these sites expand their job search possibilities. In addition, these sites allow a personal exchange between users and company representatives.