

INTRODUCTION

CONSUMPTION & CONSERVATION

Information from NEED Project 2008 (Energy Infobook)

ENERGY USE

Think about how you use energy every day. You wake up to an alarm clock. You take a shower with water warmed by a hot water heater. You listen to music on the radio as you dress. You catch the bus to school. That's just the energy you use before you get to school! Every day, the average American uses about as much energy as is stored in seven gallons of gasoline. Energy use is sometimes called energy consumption.

WHO USES ENERGY?

The U.S. Department of Energy divides energy users into three groups: residential and commercial, industrial, and transportation. These groups are called the sectors of the economy.

RESIDENTIAL & COMMERCIAL

Any place where people live is considered a residential building. Commercial buildings include offices, stores, hospitals, restaurants, and schools. Residential and commercial buildings are grouped together because they use energy in the same ways--for heating and cooling, lighting, heating water, and operating appliances.

Together, homes and buildings consume more than a third of the energy used in the United States today. In the last 30 years, Americans have reduced the amount of energy used in their homes and commercial buildings. We still heat and cool rooms, and heat hot water. We have more home and office machines than ever. Most of the energy savings have come from improvements in technology and in the ways the equipment is manufactured.

Heating & Cooling

It takes a lot of energy to heat rooms in winter and cool them in summer. Half of the energy used in the average home is for heating and cooling rooms. The three fuels used most often for heating are natural

gas, electricity, and heating oil. Today, more than half the nation's homes use natural gas for heating.

Most natural gas furnaces in the 1970s and 1980s were about 60 percent efficient. That means they converted 60 percent of the energy in the natural gas into usable heat. New gas furnaces are designed to be up to 98 percent efficient.

The second leading fuel for home heating is electricity. Electricity also provides almost all of the energy used for air conditioning. The efficiency of heat pumps and air conditioners has increased more than 50 percent in the last 30 years.

Heating oil is the third leading fuel used for home heating. In 1973, the average home used 1,300 gallons of oil a year. Today, that figure is about 800 gallons, a significant decrease. New oil furnaces burn oil more cleanly and operate more efficiently.

In the future, we may see more use of renewable energy sources, such as geothermal and solar energy, to heat and cool our homes and workspaces.



Lighting

Homes and commercial buildings also use energy for lighting. The average home spends 25 percent of its electric bill for lighting. Schools, stores, and businesses use about 60 percent of their electricity for lighting. Most commercial buildings use fluorescent lighting. It costs more to install, but it uses a lot less energy to produce the same amount of light.

Most homes still use the type of light bulb invented by Thomas Edison over 100 years ago. These incandescent bulbs are not very efficient. Only about 10 percent of the electricity they consume is converted into light. The other 90 percent is converted to heat.

Energy for Educators

Bringing Energy into the Classroom

INTRODUCTION

CONSUMPTION & CONSERVATION

Information from NEED Project 2008 (Energy Infobook)

Compact fluorescent bulbs (CFLs) can be used in light fixtures throughout homes. Many people think they cost too much to buy (about \$5 - \$10 each), but they actually cost less overall because they last longer and use less energy than incandescent bulbs.

Appliances

Over the last 100 years, appliances have changed the way we spend our time at home. Chores that used to take hours can now be done in minutes by using electricity instead of human energy. In 1990, Congress passed the National Appliance Energy Conservation Act, which requires appliances to meet strict energy efficiency standards. As a result of this Act, home appliances have become more energy efficient. Water heaters, refrigerators, clothes washers, and dryers all use much less energy today than they did 25 years ago.

Appliance Efficiency Ratings

When you buy an appliance, you should pay attention to the yellow EnergyGuide label on every appliance. This label tells you the Energy Efficiency Rating (EER) of the appliance. The EER tells how much it costs to operate the appliance.

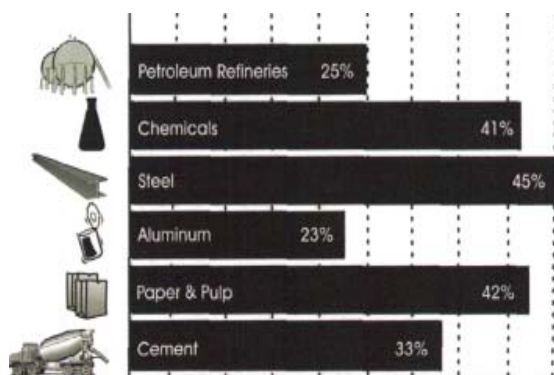
Payback Period

Whether you buy a furnace, hot water heater, or other home appliance, you must choose the best bargain. Since most high-efficiency systems and appliances cost more than less efficient ones, you have to know how much it will cost to operate the appliance each year and how many years you can expect to use it. The payback period is the amount of time you must use a system or appliance before you begin to benefit from energy savings.

For example, if you buy an efficient refrigerator that costs \$100 more, but uses \$20 less electricity each year, you would begin saving money after five years. Your payback period would be five years. Since refrigerators usually last ten years, you would save \$100 over the life of the appliance and save natural resources.

INDUSTRIAL SECTOR

The United States is a highly industrialized country. We use a lot of energy. Today, the industrial sector uses 33.4 percent of the nation's energy. Since 1973, the industrial sector has grown by two-thirds, but has used only 15 percent more energy to fuel that growth. Every industry uses energy, but six energy-intensive industries use most of the energy consumed by the industrial sector.



Petroleum Refining

The United States uses more petroleum than any other energy source. Petroleum provides the U.S. with more than 38 percent of the energy we use each year. Petroleum can't be used as it comes out of the ground. It must be refined before it can be used.

Oil refineries use a lot of energy to convert crude oil into gasoline, diesel fuel, heating oil, chemicals, and other products. Almost half of a refinery's operating costs (43%) is for energy. Refineries today use about 25 percent less energy than they did in 1973.

Aluminum Manufacturing

Aluminum is a very light-weight, versatile metal. We use aluminum to make soft drink cans, food wrap, car parts, and many other products. It takes huge amounts of electricity to make aluminum from bauxite, or aluminum ore. The cost of electricity is 30 percent of

Energy for Educators

Bringing Energy into the Classroom

INTRODUCTION

CONSUMPTION & CONSERVATION

Information from NEED Project 2008 (Energy Infobook)

the cost of manufacturing aluminum.

Today, it takes 23 percent less electricity to produce a pound of aluminum than it did 30 years ago, mainly because of recycling. Using recycled aluminum requires about 95 percent less energy than converting bauxite into metal.

Paper Manufacturing

The United States uses enormous amounts of paper every day—newspapers, books, bags, and boxes are all made of paper.

Energy is used in every step of paper making. Energy is used to chop, grind, and cook the wood into pulp. More energy is used to roll and dry the pulp into paper. In 1973, the amount of energy needed to make one ream (500 sheets) of copy paper was equal to 3.7 gallons of gasoline.

Today, with advanced technologies, the energy used to make the same amount of paper would equal just two gallons of gasoline.

The paper and pulp industry uses 42 percent less energy today, mainly because of better technology. Many industries have lowered energy use by using recycled materials. In the paper and pulp industry, it is not cheaper to use recycled paper because it costs money to collect, sort, and process the waste paper.

Recycling has other benefits, though. It reduces the amount of paper in landfills and means fewer trees must be cut.

Chemical Manufacturing

Chemicals are an important part of our lives. We use chemicals in our medicines, cleaning products, fertilizers and plastics, as well as in many of our foods.

The chemical industry uses energy in two ways. It uses

coal, oil, and natural gas to power the machinery to make the chemicals. It also uses petroleum and natural gas as major sources of hydrocarbons from which the chemicals are made.

New technology has made the chemical industry 60 percent more energy efficient than it was 30 years ago.

Cement Manufacturing

Some people think the United States is becoming a nation of concrete. New roads and buildings are being built everywhere, every day. We use lots of concrete.

Concrete is made from cement, water, and crushed stone. A lot of energy is used in making cement. The process requires extremely high temperatures—up to 3,500 degrees Fahrenheit.

Cement plants have reduced their energy consumption by one-third using innovative waste-to-energy programs. More than half of the cement plants in the U.S. now use some type of waste for fuel. These wastes, such as printing inks, dry cleaning fluids and used tires, have high energy content. For example, the energy content of one tire equals that of two gallons of gasoline. This industry is using energy that would otherwise be wasted in a landfill.



Steel Manufacturing

The steel industry uses energy to turn iron ore and scrap metal into steel. Hundreds of the products we use every day are made of steel. It is a very hard, durable metal and it must be heated to very high temperatures to manufacture it. Producing those high temperatures takes a lot of energy. The cost of energy in the steel industry is 15 to 20 percent of the total cost of making the steel. Most of this energy comes from coal, or electricity generated from coal.

Since 1973, the steel industry has reduced its energy consumption by 45 percent per ton of steel. New technology has made steel stronger so that less

Energy for Educators

Bringing Energy into the Classroom

INTRODUCTION

CONSUMPTION & CONSERVATION

Information from NEED Project 2008 (Energy Infobook)

steel is needed for many uses. For example, the Sears Tower in Chicago could be built today using 35 percent less steel.

The use of recycled steel also saves energy. It requires 33 percent less energy to recycle steel than to make it from iron ore. Today, two-thirds of new steel is made from recycled scrap, making steel the nation's leading recycled product.

TRANSPORTATION SECTOR

The United States is a big country. Twenty-seven percent of the energy we use goes to moving people and goods from one place to another.

The Automobile

Americans love automobiles. We love to drive them. We don't want anyone telling us what kind of car to buy or how much to drive it. Thirty years ago, most Americans drove big cars that used a lot of gas. The gas shortages of the 1970s didn't change Americans' driving habits much. What did change was the way automobiles were built. Automakers began making cars smaller and lighter. They built smaller and more efficient engines.

One reason for the changes was that the government passed laws requiring automobiles to get better gas mileage. With new technologies, cars now travel more miles on each gallon of gas. Today, passenger cars get an average of 30 miles per gallon. If automakers hadn't made these changes, we would be using 30 percent more fuel than we do today.

In 1973, there were 102 million cars on the road. Today, there are more than 150 million cars. There are more cars being driven more miles than ever before. Almost half of the passenger vehicles sold in 2002 were sport utility vehicles and light trucks. With the recent rise in fuel prices, however, demand

for these big vehicles has dropped, while demand for hybrids and other fuel efficient vehicles has increased.

Commercial Transportation

Passenger cars consume about two-thirds of the fuel we use for transportation. Commercial vehicles consume the rest. These vehicles—trains, trucks, buses, and planes—carry people and products all across this vast country. Commercial vehicles have also become more fuel efficient in the last 30 years.

Trucks use more fuel than any other commercial vehicle. Almost all products are at some point transported by truck. Trucks are big and don't get good gas mileage. They have diesel engines and can travel farther on a gallon of diesel fuel than they could on a gallon of gasoline. In the last thirty years, trucks have improved their gas mileage from 4.8 miles per gallon to about seven miles per gallon.

Trains carry most of the freight between cities. In the last 30 years, trains have improved their fuel efficiency by 60 percent. Trains are lighter and stronger and new locomotives are more efficient.

Airplanes move people and products all over the country. In 2006, more than 600 million passengers flew on planes. By 2010, about one billion passengers are expected to take trips on planes each year. Thirty years ago, airplanes averaged fifteen passenger miles per gallon of fuel. Today, planes average about 50 miles per gallon, and some jets get 63 mpg. Fuel is one of the biggest operating costs for airlines. Making planes more energy efficient is very important to airlines.

Mass Transit is public transportation for moving people on buses, trains, light rail, and subways. Today, there are about eight billion trips made on public



Energy for Educators

Bringing Energy into the Classroom

INTRODUCTION

CONSUMPTION & CONSERVATION

Information from NEED Project 2008 (Energy Infobook)

transit systems. That sounds like a lot, but it is less than the number of trips made in 1970. Why is this? One reason is that Americans love their cars. Another is that people have moved from cities to suburbs and many businesses have followed. Most mass transit systems were designed to move people around cities or from suburbs to cities. Very few systems move people from suburb to suburb.

Most people worry about air pollution from auto exhaust. They also worry about traffic congestion.

Congress has passed legislation supporting public transit. If public transit is convenient and the cost is reasonable, people may leave their cars at home.

ENERGY CONSUMPTION

The United States uses a lot of energy—nearly a million dollars worth each minute, 24 hours a day, every day of the year. With less than five percent of the world's population, we consume almost one fourth (24 percent) of its energy resources. People in Europe and Japan also use a large amount of energy. The average American consumes six times more energy than the world average.

EFFICIENCY & CONSERVATION

Energy is more than numbers on a utility bill; it is the foundation of everything we do. All of us use energy every day—for transportation, cooking,

heating and cooling rooms, manufacturing, lighting, and entertainment. We rely on energy to make our lives comfortable, productive, and enjoyable. To maintain our quality of life, we must use our energy resources wisely.

The choices we make about how we use energy—turning machines off when we're not using them or choosing to buy energy efficient appliances—impacts our environment and our lives. There are many things we can do to use less energy and use it more wisely. These things involve energy conservation and energy efficiency. Many people think these terms mean the same thing, but they are different.



ENERGY SUSTAINABILITY

Efficiency and conservation are key components of energy **sustainability**—the concept that every generation should meet its energy needs without compromising the energy needs of future generations. Energy sustainability focuses on long-term energy strategies and policies that ensure adequate energy to meet today's needs, as well as tomorrow's.

Sustainability also includes investing in research and development of advanced technologies for producing conventional energy sources, promoting the use of alternative energy sources, and encouraging sound environmental policies.

Energy for Educators

Bringing Energy into the Classroom