



Energy Consumption

We use energy every day. We eat food that was grown, processed, and transported to stores. We use energy to cook meals and clean up afterward. We wear clothes and shoes that were manufactured and shipped to us. We use artificial lighting throughout the day all year long. We ride in cars, trucks, buses, trains, and planes. We live in houses and work in businesses and schools made from building materials made at industrial facilities. We use energy to stay warm indoors, and we enjoy watching movies and TV shows and playing video games. The way humans have used energy has changed through history, but one thing will always be true: people use a lot of energy.

The U.S. Department of Energy divides the way we use energy into categories called **sectors**. Everything included in a sector shares similar characteristics. The sectors of the economy are **residential** (homes); **commercial** (businesses and other similar buildings); **industrial** (manufacturing complexes); **transportation** (vehicles); and **electric power** generation.

Residential and Commercial Sectors

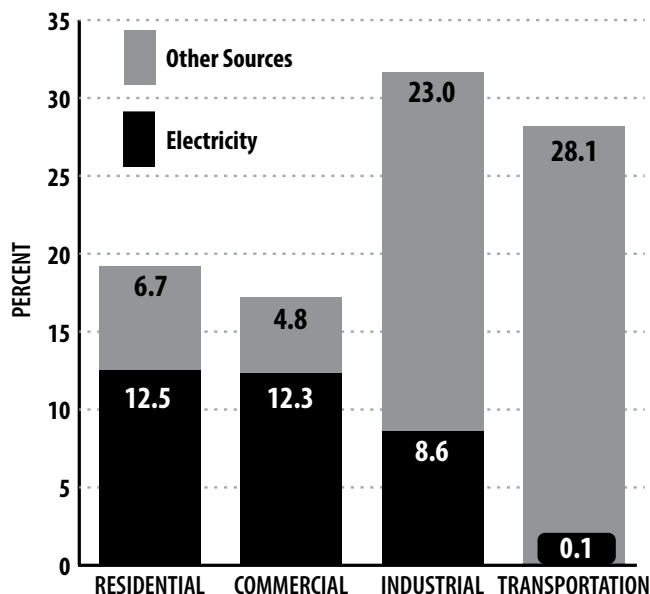
The residential and commercial sectors are often grouped together because they both use energy in similar ways. Most of the energy these two sectors use is electricity, but residential and commercial buildings use energy from other sources, too. Homes and businesses use energy for heating, cooling, lighting, and operating appliances and office machines. In the last 50 years, improvements in technology and manufacturing have helped reduce energy use.

■ Heating and Cooling

The biggest energy use in residential and commercial buildings is for keeping the interior of buildings comfortable. Heating and air conditioning use about 43 percent of all the energy used in homes, and about 51 percent in commercial buildings. The three fuels used most often for heating are natural gas, electricity, and propane. A little less than one-half of the nation's homes are heated by natural gas. Roughly 40 percent of homes use electricity for heating, and about five percent use propane. Commercial buildings follow a similar pattern: 44 percent use natural gas for heating, 43 percent use electricity, and a little less than 13 percent use propane.

Some buildings are heated and cooled by district energy systems. A district energy system uses one central facility to provide hot or chilled water (or in some cases, steam) to many buildings through underground pipes. Another way buildings stay comfortable is with geexchange systems, also called ground-source heat pumps. These systems use the nearly constant temperature a few feet underground to provide heating and cooling.

U.S. Energy Consumption by Sector, 2025



Data: EIA

■ Lighting

The first lighting used in all buildings was incandescent lighting. This very inefficient design changes most of the electricity into heat rather than light. In the mid-1900s, fluorescent lighting became common. A more efficient fluorescent light design was introduced in 1988, and fluorescent lighting became the most widely used lighting in commercial buildings. Incandescent lights remained dominant in homes. In 2007, legislation required better energy efficiency in all areas, including lighting, and new technologies were developed.

INCANDESCENT BULB



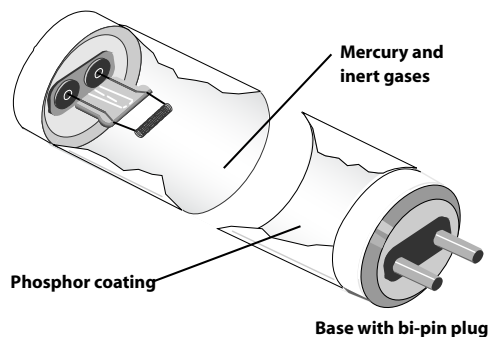
LED BULB



LEDs offer better light quality than incandescent bulbs, last 25 times as long, and use less energy than compact fluorescent lamps (CFLs). LEDs now have a wide array of uses because technology has improved and costs have decreased. Some may still use incandescent, fluorescent, or halogen bulbs in their fixtures at home.

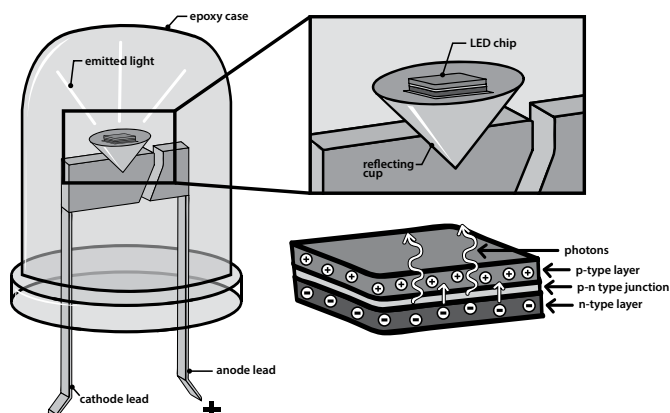
Today, **light-emitting diode (LED)** lighting is most common in homes and newly constructed or renovated commercial buildings. Residential customers spend about \$89 annually just to operate lights. About 10 percent of all energy consumed in commercial buildings is for lighting, which is about 17 percent of the electricity used by schools. The actual dollar amount spent varies widely because some commercial buildings, like small coffee shops, are quite small while others, like museums and hospitals, are huge.

Fluorescent Tube Lamp



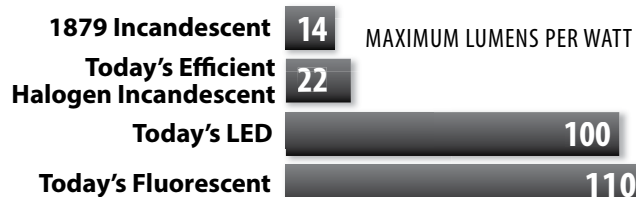
In fluorescent tubes, a very small amount of mercury mixes with inert gases to conduct the electric current. This allows the phosphor coating on the glass tube to emit light.

Inside an LED



LEDs offer better light quality than incandescent bulbs and halogens, last 25 times as long, and use even less energy than CFLs. LEDs now have a wide array of uses because technology has improved and costs have decreased. CFLs are not as available in stores, and their use has drastically decreased, like the use of halogen bulbs. Some may still use these bulbs in their fixtures at home. They come in several shapes and sizes.

Lighting Efficiency



Data: Madison Gas and Electric

Appliances

Appliances have made our lives cleaner, easier, and safer. Water heaters use the most energy in this category—about five percent in commercial buildings and 15 percent in residential buildings. Most homes use the same energy source for home heating and water heating.

Refrigerators and freezers are the next-largest energy consumer. These appliances use a substance called a refrigerant to move thermal energy from inside the appliance to the surrounding room. Air conditioners use a similar process, moving thermal energy outdoors.

Additional appliances include dishwashers, washing machines, dryers, humidifiers, dehumidifiers, ranges, cooktops, ovens, microwaves, and many small, plug-in devices like fans, coffee makers, and crock pots. When electronics like TVs, cable boxes, and gaming systems are added, the amount of energy—primarily as electricity—we consume to live our lives becomes overwhelming.

HOUSEHOLD APPLIANCES



Images courtesy of Adobe Stock

Appliances range from kitchen essentials to TV's.

▪ Smart Things

There is no question that the internet has dramatically changed modern life. As home internet access has become commonplace, manufacturers developed products that could connect to home networks and be controlled remotely.

The modern smart-home era began when the Nest® smart thermostat was introduced. This Wi-Fi-connected control system allows the user to change settings with a smartphone. It also has the ability to recognize patterns in users' behavior and make adjustments, saving energy. Smart light bulbs from Philips were introduced about a year later, followed by smoke detectors, cameras, and door locks. In 2014, the Amazon Alexa burst onto the scene and rapidly grew in popularity. About half of all homes in the U.S. have at least one smart device, with the most popular items being smart TVs, voice assistants, and doorbell cameras.

The energy consumption of the "smart" part of Wi-Fi-enabled electronics and appliances is difficult to determine. Surveys of home energy use do not typically separate smart devices from ordinary devices. However, smart things can be very useful when it comes to saving energy. Utilities frequently offer rebates for customers who allow the utility to adjust their smart thermostats during periods of high electricity demand. People who manage large buildings and campuses take advantage of the remote control capabilities of smart devices, especially thermostats and lighting, as an energy-saving strategy. Smart devices are not only convenient, they can help us track and control energy consumption.

Industrial Sector

The facilities that make both raw and finished products—factories, foundries, and refineries—make up the industrial sector. In 2025, 32.9 percent of U.S. energy consumption, including electricity, was used to make products and materials. American industry accounts for about 17 percent of the world's total manufacturing output. Every industry uses energy, but six industries account for the most energy use.

▪ Petroleum Refining

Crude oil is a mixture of many compounds. To be useful, the compounds must be separated at a refinery. The compounds in petroleum are separated by boiling point, and all that boiling requires a lot of thermal energy. Most of the energy used by the refinery comes from the petroleum itself. Petroleum refining is the second-largest energy consumer in the industrial sector.

▪ Steel Manufacturing

Steel is made from iron ore in a steel mill. Most iron ore mined in the United States comes from the Lake Superior region, especially northern Minnesota and Michigan's Upper Peninsula. The ore is often transported to steel mills by ships on the Great Lakes. At the mill, iron ore is heated in a blast furnace, and the molten iron is mixed with different elements to make steel. Different types of steel contain different amounts and combinations of elements, giving them different properties.

When making steel, energy costs are about 15 percent of the total production cost. Since 1990, the steel industry has reduced its energy consumption by improving technology, closing older plants, and the increasing use of recycled steel. Recycling steel uses 75 percent less energy than making it from iron ore.

ALEXA

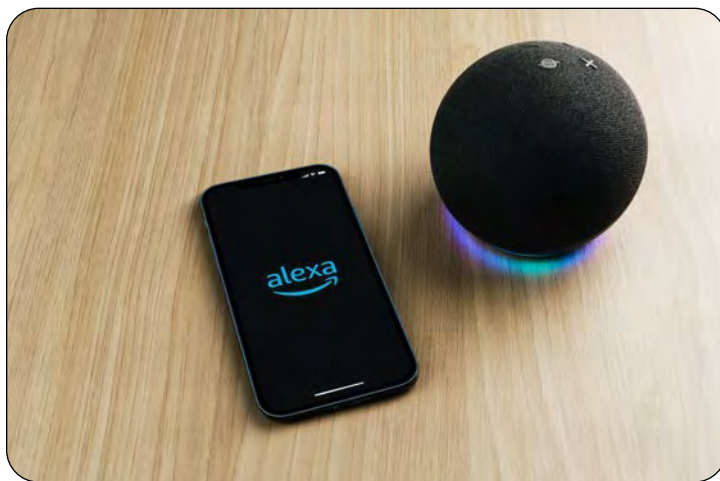


Image courtesy of Adobe Stock

PETROLEUM REFINERY



Image courtesy of BP

STEEL PRODUCTION



Image courtesy of Adobe Stock/ Tayiba Photography

▪ Aluminum Manufacturing

Aluminum manufacturing begins by mining **bauxite**, a mineral rich in aluminum. Bauxite is then heavily processed to produce aluminum. Manufacturing aluminum is very energy-intensive. The aluminum industry has significantly reduced the amount of energy needed to produce aluminum, mostly through aluminum recycling. Recycling aluminum uses 95 percent less energy than producing the same amount of aluminum from bauxite.

▪ Paper Manufacturing

The U.S. uses enormous amounts of paper every day, and energy is required in every step of the paper-making process. Energy is used to chip, grind, and cook the wood into pulp, and more is needed to roll and dry the pulp into paper. Forestry, paper, and paper products manufacturing is the third-largest energy consumer in the industrial sector.

The pulp and paper industry reduced the amount of fossil fuels used by using better technology and **cogeneration** systems, which provide heat and electricity. Over 60 percent of the fuel used to power the cogeneration equipment comes from wood waste, a renewable energy source.

▪ Chemical Manufacturing

The chemical industry plays a huge role in modern daily life, creating soap, paint thinner, medicines, cleaning products, fertilizers, food containers and wraps, and the raw materials used to make plastics. A lot of food products also include ingredients produced by chemical manufacturing. Because it produces such a wide variety of products, chemical manufacturing is the largest energy consumer in the industrial sector.

Manufacturing chemicals uses a lot of electricity, petroleum, and natural gas. Some of the petroleum and natural gas are used as raw materials for making other products and not for energy.

▪ Cement Manufacturing

Imagine how much time and money would be spent to build bridges, power plants, and dams from stone. Concrete is made from cement, water, sand, and gravel and is a major component of many of the large structures you see around you.

Using a lot of concrete has two major drawbacks. First, Portland cement is made from a chemical reaction that uses limestone and produces carbon dioxide as a byproduct. That does not include any carbon dioxide produced from the energy sources used to make it. Second, making concrete requires an enormous amount of energy to make and transport cement, mix concrete, and haul it where it is used. A lot of the cement made in the United States is exported.

New technologies have reduced the fossil fuel consumption in the cement manufacturing industry. Today, about 16 percent of the energy used to make cement comes from alternative energy sources such as used tires. Used tires have about 25 percent more energy than coal. The American Cement Association is looking for ways to reduce the carbon dioxide produced from cement manufacturing and concrete production. They hope to be carbon-free by 2050.

PAPER RECYCLING



Image courtesy of National Laboratory of the Rockies

Transportation Sector

The United States is a nation on the move. We move ourselves from home to work or school or on vacation. We visit friends and relatives. We attend sporting events and concerts. We go shopping and out to eat. We visit museums and places of worship. And sometimes, we just get out of the house for its own sake. Moving people and their goods is the business of the transportation sector, and it requires a lot of energy. In 2025, about 29 percent of all of the energy consumed in the U.S. was used to move people, goods, and even energy.

▪ The Automobile

Few technologies have influenced American life as much as the automobile. While large cities in Europe and Asia were developed before any modern transportation was contemplated, many of the large cities in the United States were developed and expanded around the idea that people would primarily use cars to get around. The automobile is the primary transportation method people use and the largest consumer of transportation energy in the U.S. today.

TRAFFIC CONGESTION



Image courtesy of Adobe Stock/ Goran Jakus

Americans' relationship with the automobile changed dramatically during the twentieth century. Early drivers rarely traveled far from home, relying on trains for longer journeys. As automobiles improved and the nation's highway system expanded, long-distance driving became practical, and the great American road trip became part of the culture.

The oil embargoes of the 1970s brought a new concern: fuel economy. For the first time, many consumers began paying close attention to how much gasoline their vehicles used. Automakers responded by designing cars that were lighter, more aerodynamic, and propelled by engines with improved fuel efficiency. Today's cars drive almost twice as far on a gallon of gasoline as the vehicles of the 1970s. Furthermore, vehicle technology has improved to include alternative fuels, hybrid-electric vehicles, and fully electric vehicles, which reduces energy consumption in the transportation sector.

■ Commercial Transportation

Passenger vehicles are typically owned and operated by individuals for their own needs. Commercial vehicles are owned by businesses, governments, and corporations to transport manufactured goods and provide services. Trucks are used to move goods. In fact, almost every product is carried at some point in a truck. Most trucks, from large pickups to the biggest semi-tractor trailers, run on diesel fuel. Trains are also used to carry goods on land. Locomotives run on electricity from diesel-powered generators to pull freight on our nation's railroads. Many large industrial complexes have railroad tracks running through them to facilitate receiving raw materials and shipping finished products.

On water, ships and barges are used to carry items. Bulk products like coal are carried by barge and moved around by tugboats. A tug can move several barges at one time. Ships might have large holds below deck to carry bulk items like grain or iron ore, or they might have wide, flat decks upon which steel containers with finished goods are stacked. Most ships run on a specially formulated diesel fuel.

If you need transportation in a hurry, you will probably ship your package by air. Jet planes have gone through many design changes over the last 50 years. Today's jets are faster and more efficient, and can move dozens of passengers or tons of freight several hundred miles in a matter of hours. It is 10 times more expensive to transport goods via plane than by truck or train.

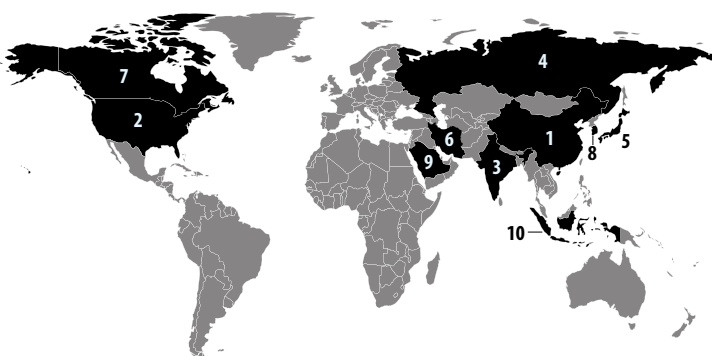
■ Public Transportation

Moving people in large groups by bus and train is the job of public transportation. This category is different from commercial transportation because the buses and trains are typically owned and operated by a municipal or state government, not a private company. Passengers walk to a station and board a bus or train that takes them to another station. The people might transfer to another bus or train, or they might have arrived at their destination. Many city train systems, especially those that run underground, are electric. Buses have traditionally been fueled by diesel fuel, compressed natural gas, or propane. New bus technology includes electric buses or those running on hydrogen fuel cells.

Global Energy Consumption

Energy consumption patterns in the United States are not the same for all countries. In fact, from continent to continent and country to country, energy consumption depends greatly on the natural resources available, political stability, and economic conditions. China and India have greatly expanded access to energy in recent decades as their economies have grown, increasing energy use per person. Countries with a lot of petroleum or natural gas reserves, like Saudi Arabia and Kuwait, rely heavily on petroleum and natural gas. Japan and South Korea have few domestic energy resources and must import much of the energy they consume. Brazil, a nation with a mix of rural, suburban, and urban populations and a wide range of income levels, obtains about half of its energy from renewable sources like biomass and hydropower. Access to energy can be very limited if an area is going through conflict or experiencing poverty.

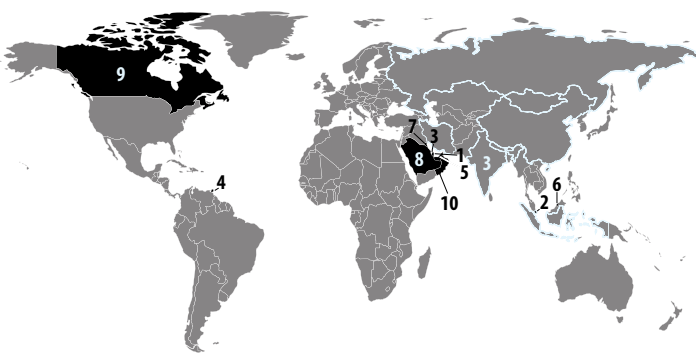
Top Ten Energy Consumers, 2024



- | | | | | |
|------------------|-----------|----------|----------------|-----------------|
| 1. China | 3. India | 5. Japan | 7. Canada | 9. Saudi Arabia |
| 2. United States | 4. Russia | 6. Iran | 8. South Korea | 10. Indonesia |

Data: EIA

Top Ten Countries, Energy Consumption per Capita, 2024



- | | | | | |
|--------------|----------------------|-------------------------|-----------------|-----------|
| 1. Qatar | 3. Bahrain | 5. United Arab Emirates | 7. Kuwait | 9. Canada |
| 2. Singapore | 4. Trinidad & Tobago | 6. Brunei | 8. Saudi Arabia | 10. Oman |

Data: EIA