

Electricity

Electricity

Electricity is the flow of electric power or charge. Electricity is naturally occurring in nature, but we also generate a lot of electricity to meet our everyday needs.

Power plants use huge turbine generators to generate the electricity that we use in our homes and businesses. Power plants use many fuels to spin the turbines. They can burn coal, oil, or natural gas to make steam to spin turbines. They can split atoms of uranium to heat water into steam. They can also use the power of rushing water from a dam or the wind to spin the turbine.

Fuels Used to Generate Electricity

Three basic types of power plants generate most of the electricity in the United States—fossil fuel, nuclear, and hydropower. There are also wind, geothermal, waste-to-energy, and solar power plants, but they generate less than ten percent of the electricity produced in the United States.

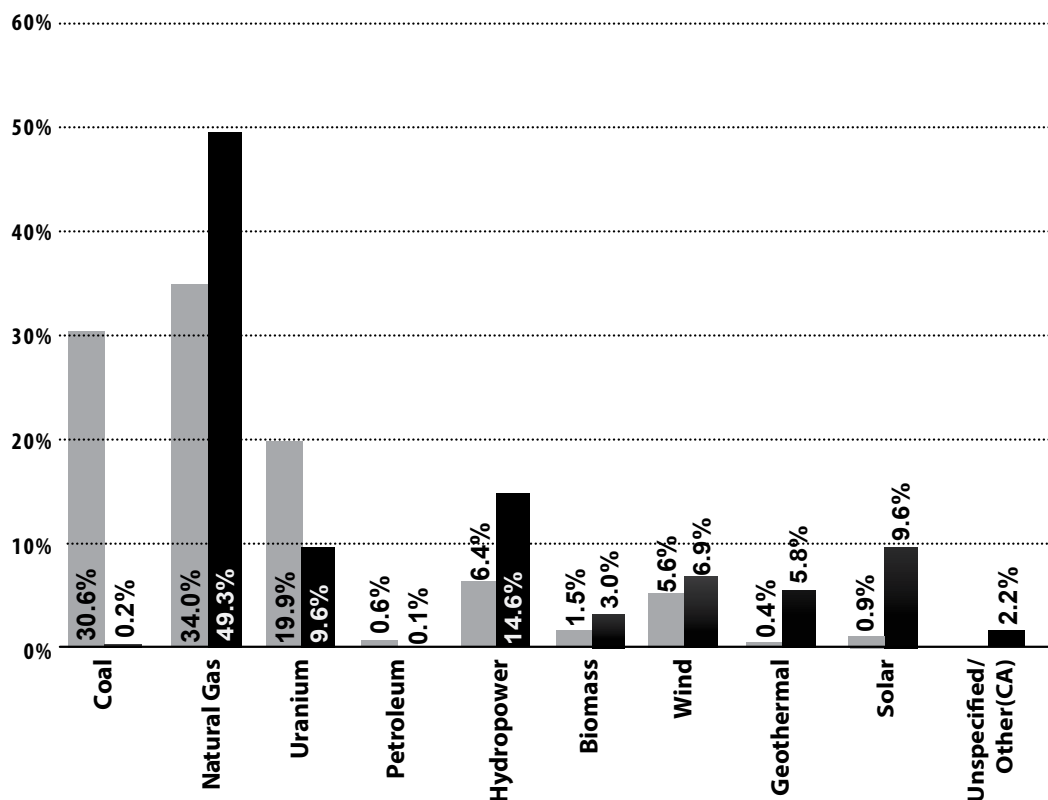
Fossil Fuel Power Plants: Fossil fuel plants burn coal, natural gas, or oil. These plants use the chemical energy in fossil fuels to superheat water into steam, which drives a turbine generator. Fossil fuel plants

are sometimes called thermal power plants because they use heat to generate electricity. Natural gas is the fossil fuel of choice for most electric companies, producing 34.0 percent of total U.S. electricity. Coal plants produce 30.6 percent. Petroleum produces less than one percent of the electricity in the U.S.

Nuclear Power Plants: Nuclear plants generate electricity much as fossil fuel plants do except that the furnace is called a reactor and the fuel is uranium. In a nuclear plant, a reactor splits uranium atoms into smaller elements, producing heat in the process. The heat is used to superheat water into high-pressure steam, which drives a turbine generator. Nuclear power plants are called thermal plants because they use heat to generate electricity. Nuclear energy produces 19.9 percent of the electricity in the U.S.

Hydropower Plants: Hydropower plants use the gravitational force of falling water to generate electricity. Hydropower is the least expensive way to produce electricity in this country, but there are few places where new dams can be built. There are some existing dams that could be retrofitted with turbines and generators. Hydropower is called a renewable energy source because it is renewed continuously during the natural water cycle. Hydropower produces five to ten percent of the electricity in the U.S., depending upon the amount of precipitation.

Comparing U.S. and California In-State Electricity Portfolios, 2016



In 2013 California emitted more carbon dioxide into the atmosphere than any other state except Texas. In an effort to reduce their greenhouse gas (GHG) emissions, California has implemented policies that will help them reduce emissions to their 1990 levels. California's current electricity generation mix reflects their air quality standards, and their goal to generate 33 percent of their electricity from renewable energy sources by 2020, and 50 percent by 2030.

U.S. 
CA 

Data: U.S. Energy Information Administration, California Energy Almanac, California Energy Commission

Power to the People

Most electricity is generated by large utility companies; it is their responsibility to make sure electricity is available when we need it. They must consider reliability, capacity, baseload, power pools, and peak demand.

Reliability is the capability of a utility company to provide electricity to its customers 100 percent of the time. A reliable electric service is without blackouts or brownouts. To ensure uninterrupted service, laws require most utility companies to have 15 to 20 percent more capacity than they need to meet peak demand.

This means a utility company whose peak load is 12,000 MW (megawatt) must have 14,000 MW of installed electrical capacity. This ensures that there will be enough electricity to meet demand even if equipment were to break down on a hot summer afternoon.

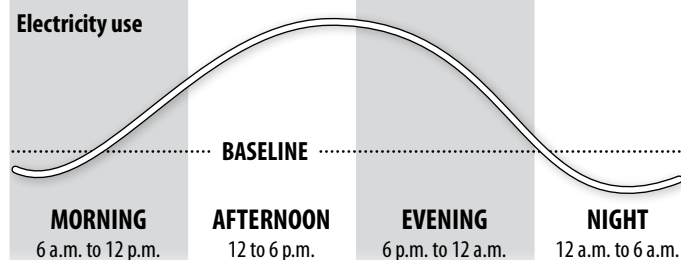
Capacity is the total quantity of electricity a utility company has on-line and ready to deliver when people need it. A large utility company may operate several power plants to generate electricity for its customers. A utility company that has seven 1,000-MW plants, eight 500-MW plants, and 30 100-MW plants has a total capacity of 14,000 MW.

Baseload power is the electricity generated by utility companies around the clock, using the most inexpensive energy sources—usually coal, nuclear, and hydropower. Baseload power stations usually run at full or near capacity.

When many people want electricity at the same time, there is a peak demand. Power companies must plan for times of peak demand so there is enough power for everyone. During the day's peak, between 12:00 noon and 6:00 p.m., additional generators must be used to meet a higher demand for energy use. These peak load generators run on natural gas, diesel, or hydro and can be put into operation in minutes. The more this equipment is used, the higher our utility bills. By managing the use of electricity during peak hours, we can help keep costs down.

The use of power pools is another way that electric power companies make their systems more reliable. Power pools link electric utilities together so they can share power as it is needed. A power failure in one system can be covered by a neighboring power company until the problem is corrected. There are nine regional power pool networks in North America. The key is to share power rather than lose it.

Peak Demand



Peak load is the maximum load during a specified period of time.

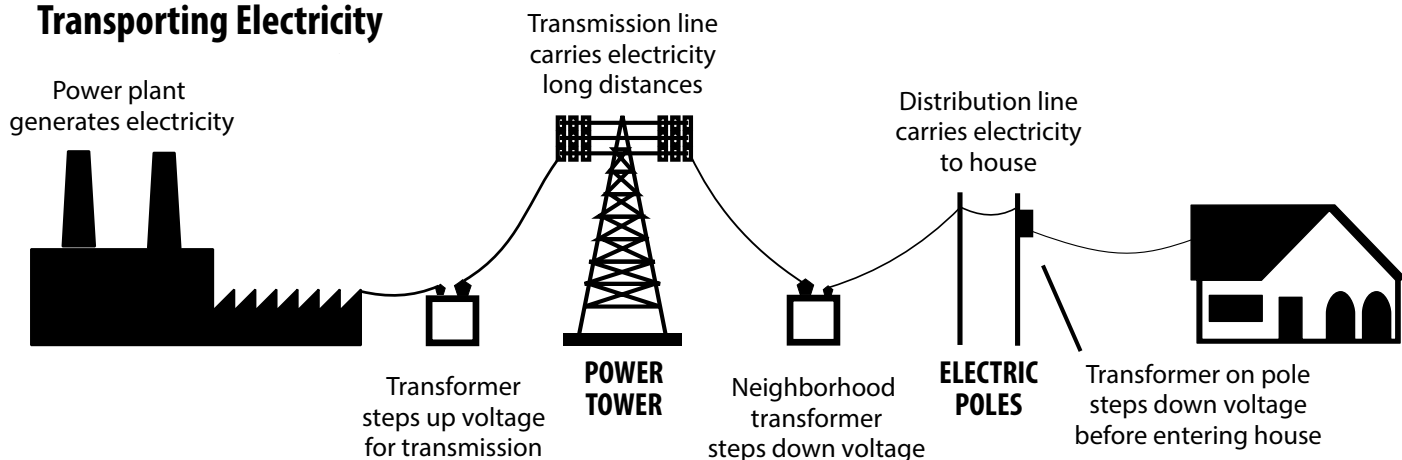
The Electric Grid

To deliver electricity to consumers, there are more than 160,000 miles of high-voltage electric transmission lines across the U.S. These lines move the electricity produced at power plants to transformers that step up the voltage to reduce energy loss while the electricity travels along the grid to where it is going to be used. Before coming into your home, another transformer steps down the power to 120 volts so it can operate your lights, appliances, and other electrical needs. And most remarkably of all, this entire process—from generation at the power plant to the trip along the lines to its availability for use in your home—takes just a fraction of a second!

These transmission lines—whether they are located on poles above ground or buried underground—make up the most visible part of what is called the “electric grid.” The grid consists of the power generators, the power lines that transmit electricity to your home, the needed components that make it all work, and the other homes and businesses in your community that use electricity.

The process starts at the power plant that serves your community, and ends with wires running from the lines into your home. Outside your home is a meter with a digital read-out or a series of dials that measure the flow of energy to determine how much electricity you're using. Of course, there are many more parts to this process, ranging from substations and wires for different phases of current to safety devices and redundant lines along the grid to ensure that power is available at all times. You can see why the U.S. National Academy of Engineering has called America's electric grid “the greatest engineering achievement of the 20th century.”

Transporting Electricity



The Smart Grid

The current electric grid is aging and plans are underway to update it and create a “smart grid.” The existing electric grid has worked well for many years, but developing a new, more efficient grid will help meet growing electricity demand. Updating the current grid and transmission lines would not only improve current operations, but would also open new markets for electricity generated by renewable energy sources.

The smart grid system will include two-way interaction between the utility company and consumers. During peak demand when power generation is reaching its limit, the utility company can contact consumers to alert them of the need to reduce energy until the demand decreases. The smart grid would alert the power provider to an outage or power interruption long before the homeowner has to call the provider to let them know the power is out.

Developing the smart grid would offer a variety of technologies that will help consumers lower their power usage during peak periods, allow power producers to expand their use of photovoltaics (solar), wind, and other renewable energy technologies, provide system back-up to eliminate power outages during peak times, and save money while reducing carbon dioxide emissions.

The nation’s evolution toward a smart grid is already paving the way for new technologies and products that will help Americans use energy more wisely. California’s statewide effort to upgrade to a smart grid will lead to more efficient and reliable power, a reduced carbon footprint, and the creation of green jobs and clean-energy development. Around the world, and across the United States, new wireless digital meters are being installed that enable two-way communication between energy providers and the meters. The many benefits of smart metering technology include the consumer’s ability

SMART METER INSTALLATION



to see how and when they are using energy and the provider’s ability to quickly identify outages and restore power. In the future, consumers will be able to purchase in-home energy management devices and smart appliances that communicate with smart meters to help reduce energy use.

The typical family can spend about \$1,900 a year on utility bills. If your home is wasting energy—through leaky windows and ducts, old appliances, inefficient heating and cooling systems, or simply wasteful bad habits—you are throwing away money your family could spend in other ways. Learning and practicing smart ways to use and conserve energy in your home, will save money for your family.

The Continental U.S. Electric Grid



Data: U.S. Energy Information Administration