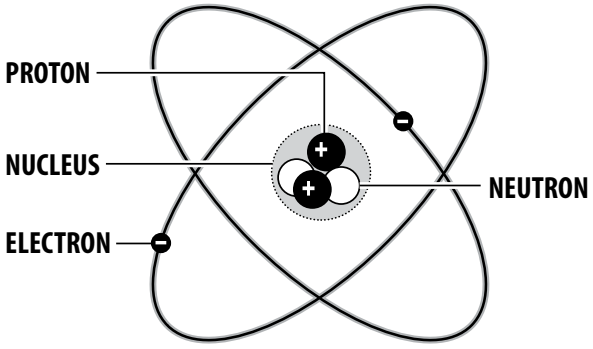
Electricity

Electricity is a mysterious force. We can't see it like we see the sun. We can't hold it like we hold coal. We know when it is working, but it is hard to know exactly what it is. Before we can understand electricity, we need to learn about atoms.

Atoms

Everything is made of **atoms**—every star, every tree, every animal. Even people are made of atoms. The air and water are, too.

Atoms are the building blocks of the universe. They are very, very tiny particles. Millions of atoms would fit on the head of a pin.



Protons, Neutrons, and Electrons

An atom looks like the sun with the planets spinning around it. The center is called the **nucleus**. It is made of tiny **protons** and **neutrons**. **Electrons** move around the nucleus in **energy levels**, or shells, far from the nucleus.

When an atom is in balance, it has the same number of protons and electrons. It can have a different number of neutrons.

Electrons stay in their shells because a special force holds them there. Protons and electrons are attracted to each other. Protons have a **positive charge (+)** and electrons have a **negative charge (–)**. Opposite charges attract each other.

Electricity Is Moving Electrons

The electrons near the nucleus are held tight to the atom. Sometimes, the ones farthest away are not. We can push some of these electrons out of their energy levels. We can move them. Moving electrons are called electricity.

Magnets Are Special

In most objects, all the atoms are in balance. Half of the electrons spin in one direction; half spin in the other direction. They are spaced randomly in the object. Magnets are different.

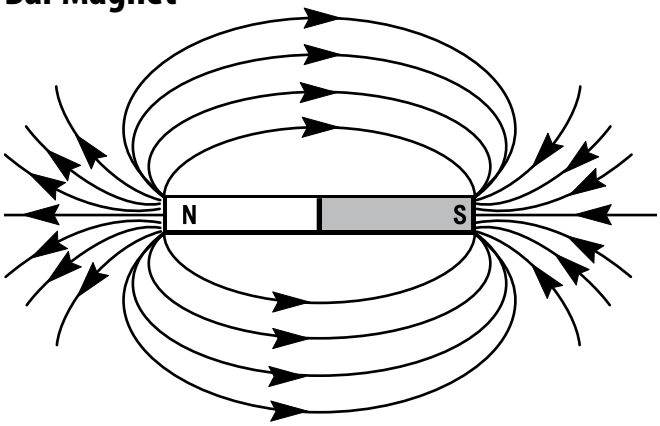
In **magnets**, the atoms are arranged so that the electrons are not in balance. The electrons don't spin in a balanced way. Instead, the electrons line up. This creates a force of energy called a **magnetic field** around a magnet.

We call one end of the magnet the **north (N) pole** and the other end the **south (S) pole**. The force of the magnetic field flows from the north pole to the south pole.

Have you ever held two magnets close to each other? They don't act like most objects. If you try to push the two north poles together, they **repel** each other. If you try to push the two south poles together, they repel each other.

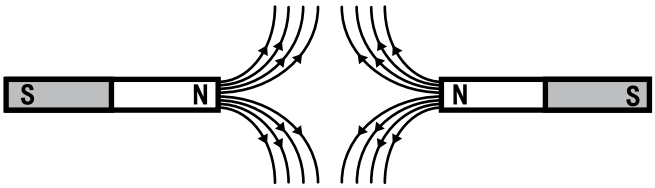
Turn one magnet around and the north and the south poles **attract**. The magnets stick to each other with a strong force. Just like protons and electrons, opposites attract.

Bar Magnet



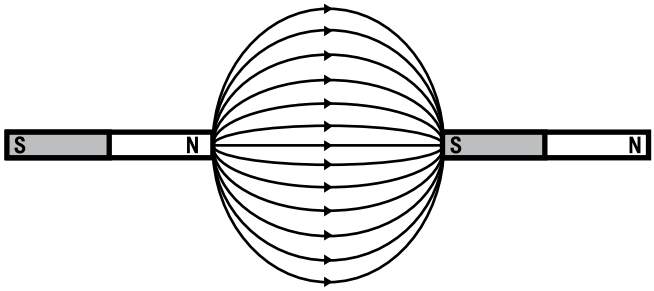
Like Poles

Like poles of magnets (N-N or S-S) repel each other.



Opposite Poles

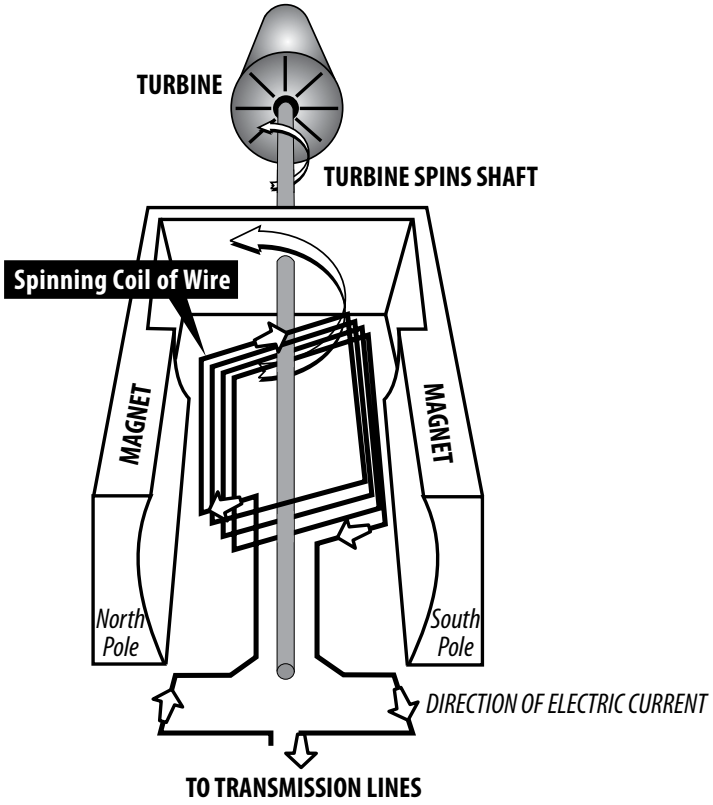
Opposite poles of magnets (N-S) attract each other.



Magnets Can Make Electricity

We can use magnets to make electricity. A magnetic field can pull and push electrons to make them move. Some metals, like copper, have electrons that are loosely held. They are easily pushed from their shells.

Magnetism and electricity are related. Magnets can create electricity and electricity can produce magnetic fields. Every time a magnetic field changes, an electric field is created. Every time an electric field changes, a magnetic field is created. Magnetism and electricity are always linked together; you can't have one without the other. This is called **electromagnetism**.



Power Plants Use Magnets

Power plants use huge magnets to make, or generate, electricity. In a **generator**, a big coil of copper wire spins inside the magnets. As it spins, the magnetic fields push and pull electrons in the wire.

The electrons in the copper wire flow into power lines. These moving electrons are the electricity that powers our houses.

Power plants use giant wheels called **turbines** to spin the coils of wire in the generators. It takes a lot of energy to spin turbines. Power plants use many fuels to get that energy.

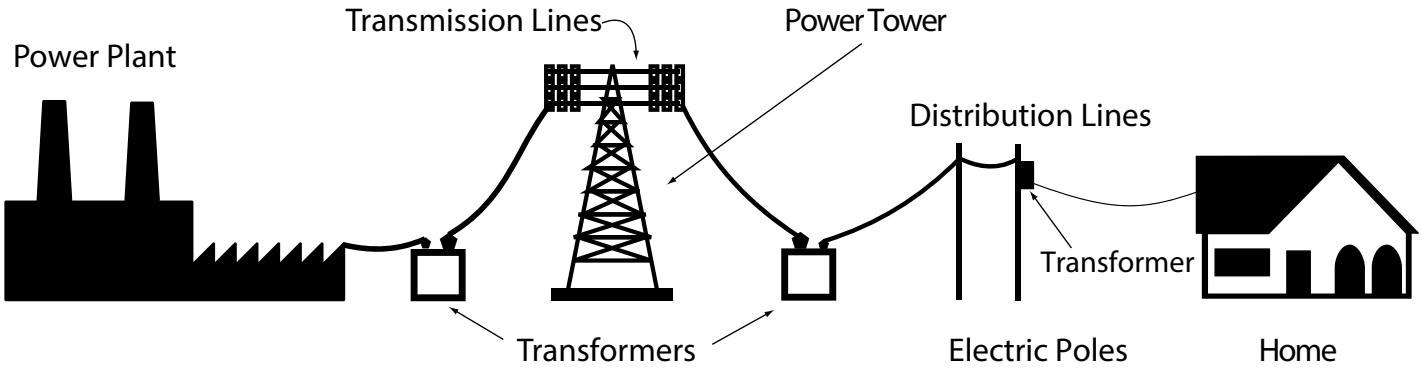
TURBINE ROOM AT SAFE HARBOR

Photo of Safe Harbor Water Power Corporation on the Lower Susquehanna River in Pennsylvania.

Electricity Travels Through Wires

The spinning turbines make electricity. It flows into **power lines**. The electrons flow through the power lines to our houses. They flow through the wires in our houses and back to the power plant. Then they start their journey again.

Transporting Electricity



There are many different types of power lines. The power plant makes electricity. The electricity flows through **transmission lines** held up by **power towers**. The transmission lines carry large amounts of electricity to electric poles in cities and towns.

Distribution lines carry small amounts of electricity from the **electric poles** to houses and businesses. **Transformers** make sure the electricity is in the proper units (**voltage**) for us to safely use.

Electricity Travels in Loops

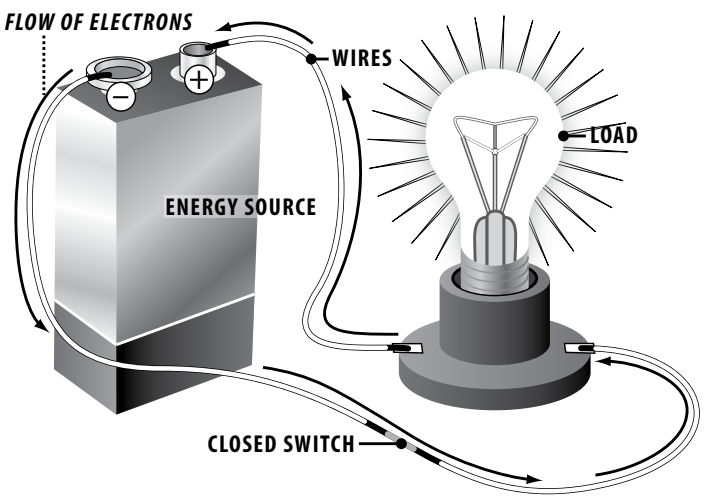
Electricity travels in closed loops, or **circuits** (from the word circle). It must have a complete path from the power plant through the wires and back.

If a circuit is open, the electricity can't flow. When we flip on a light switch, we close a circuit. The electricity flows through the light and back into the wire. When we flip the switch off, we open the circuit. No electricity flows to the light. It flows straight through the switch.

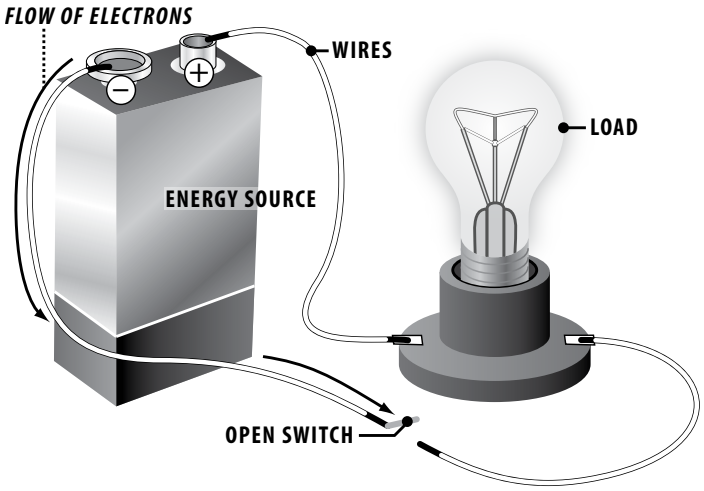
We Use Electricity Every Day

Electricity does a lot of work for us. We use it many times each day. It lights our homes, warms and cools our rooms, and helps us keep them clean. It runs our TVs, DVRs, video games, computers, and fax machines. It cooks our food and washes the dishes. It can power our lawn mowers and leaf blowers. It can even run our cars. We use a lot of electricity every year.

Electric Circuits

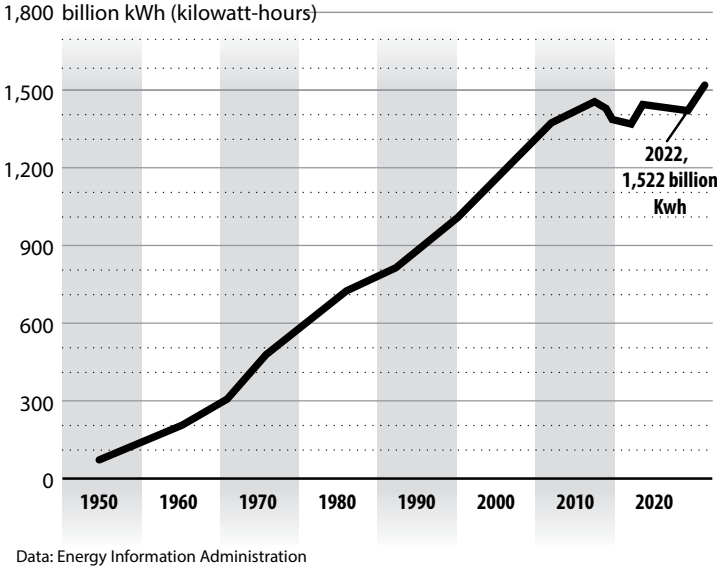


A **closed circuit** is a complete path allowing electricity to flow from the energy source to the load.



An **open circuit** has a break in the path. There is no flow of electricity because the electrons cannot complete the circuit.

Residential Electricity Use



Data: Energy Information Administration