



The ABCs of Electricity





Electricity Has Helped Shape our History for Over 2 Centuries

1740s – 1750s

Ben Franklin conducted his famous (but very dangerous) experiments and invented the lightning rod.

1876

Alexander Graham Bell invented the telephone.

1879-1882

Thomas Edison invented the incandescent light bulb. He also built the country's first power plant.

1880s-1890s

Granville T. Woods invented many electrical devices for the telephone and telegraph.

1935

The Rural Electrification Administration was created.

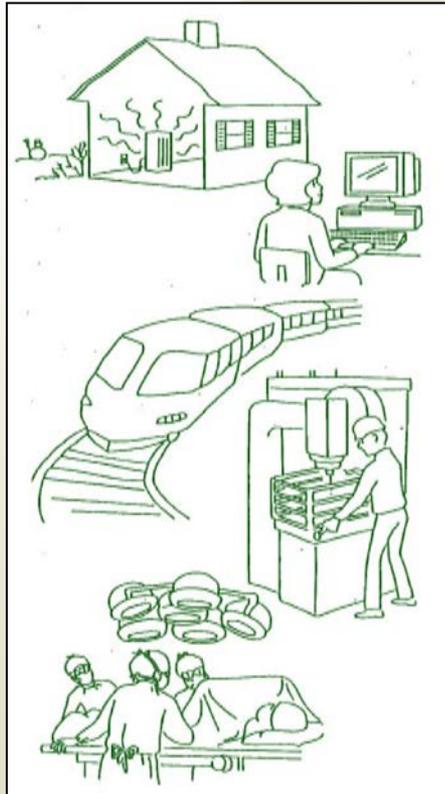
1940s-1950s

Grace Murray Hopper's work helped start the electronic computer revolution.





Today, Electricity is One of Our Main Power Sources



We Depend on Electricity For:

- heating, cooling, lighting and cooking
- work and entertainment
- transportation and communication
- farming and industry
- health care.

But We Need To Use It Wisely To:

- conserve limited resources
- protect the environment
- reduce pollution
- promote economic growth.

Our standard of living depends on electric power– and how we use it!





Basic Facts About Electricity

Electricity Is A Form of Energy

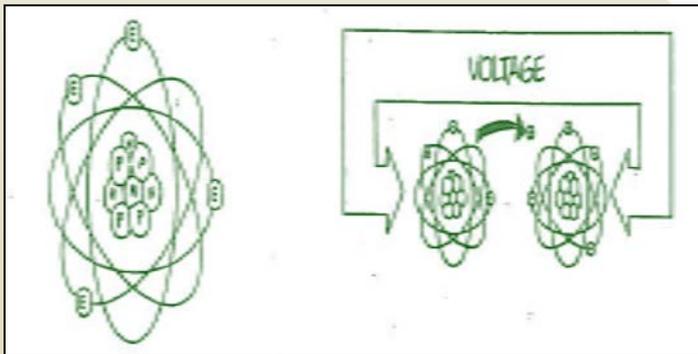
That begins with the atom.

Atoms are made up of:

- Protons- positive charge
- Neutrons – no charge
- Electrons – negative charge.

Electricity Is Created

When an outside force (called “voltage”) causes electrons to move from atom to atom. This flow of electrons is called an “electrical current.”

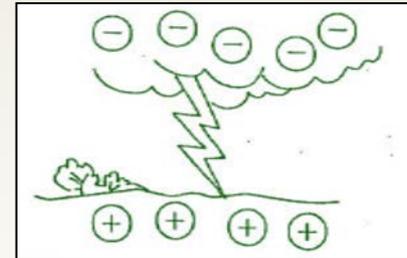


There Are 2 Kinds of Electricity:

• Static electricity

occurs when there's an imbalance of positively and negatively charged atoms. Electrons then jump from atom to atom, releasing energy.

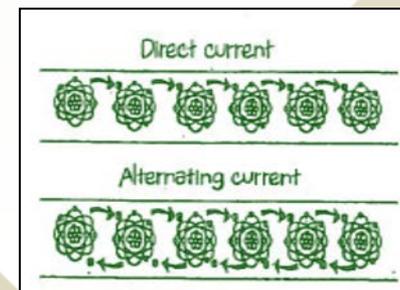
Lightning is a form of static electricity.



Current electricity

Is a constant flow of electrons. Direct current (DC) means the electrons move in one direction. Alternating current (AC) means the electrons flow in both directions.

Power Plants make AC.

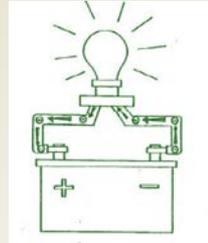




There Are 2 Basic Ways to Make Electricity:

1. Batteries

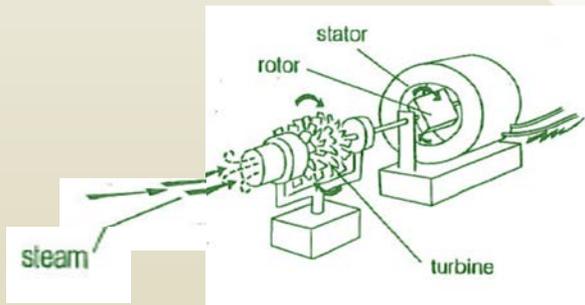
Chemical reactions force electrons to move. This creates DC electricity.



2. Generators

By spinning a magnet (called a “rotor”) inside coils of wire (a “stator”), electricity can be generated.

- A turbine, or engine, spins the rotor.
- The spinning rotor causes electrons in the stator to flow. This produces AC electricity.



More Terms

- **Circuits** are the paths that electricity follows.
- **Conductors**, such as water and most metals, let electricity flow through them.
- **Insulators**, or nonconductors such as plastic and glass, do not let electricity flow through them.

More Facts

Electricity:

- **can't generally be stored**
--and it has no weight, size, color or odor.
- **travels at the speed of light**
--186,000 miles per second.
- **was “discovered” In Greece**
-- over 2,500 years ago.

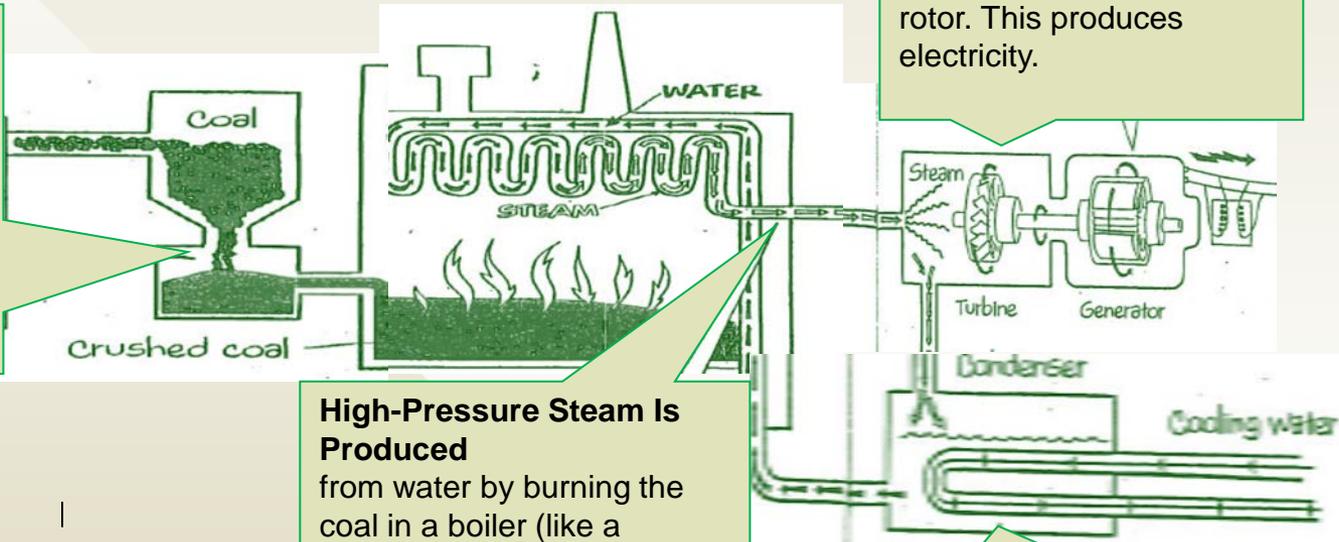




How Electricity is Generated

Most power plants in the U.S. use coal to make electricity. Here's how:

Coal is Crushed into powder or pellets. (Sometimes it is also cleaned at this step.)



High-Pressure Steam Is Produced from water by burning the coal in a boiler (like a furnace).

The Steam Turns The Turbine Blades, which spin the generator rotor. This produces electricity.

Emission Control Equipment Captures most of the ash and gases from the burning coal. Some of the ash is recycled as a cement substitute in concrete.

A Condenser Recycles Most of the Steam, converting it back to water. The water is reused in the boiler.





Electricity is also generated from:



Natural Gas or Oil

A gas, oil, or combination gas-coal boiler produces steam. Some plants burn natural gas to produce hot gases which are used in place of steam.



Nuclear Energy

A controlled nuclear reaction called “fission” causes atoms to split and release heat. This heat is used to produce steam.



Hydropower

Instead of steam or gas, falling water turns the turbine.

Other Sources

of electricity include:

- solar power
- wind power
- biomass (using organic materials to produce steam)
- geothermal power (using steam from beneath the earth's surface)
- ocean or tidal power
- fuel cells (similar to giant batteries).





The Transmission System

Most power plants in the U.S. and certain parts of Canada are connected by a complex network, or grid. This system delivers electricity to you instantly! Here's how:

1. Electricity Flows From The Power Plant

It passes through transformers that “step up,” or increase, the voltage. This helps electricity travel farther.

2. Electricity Enters the Transmission System

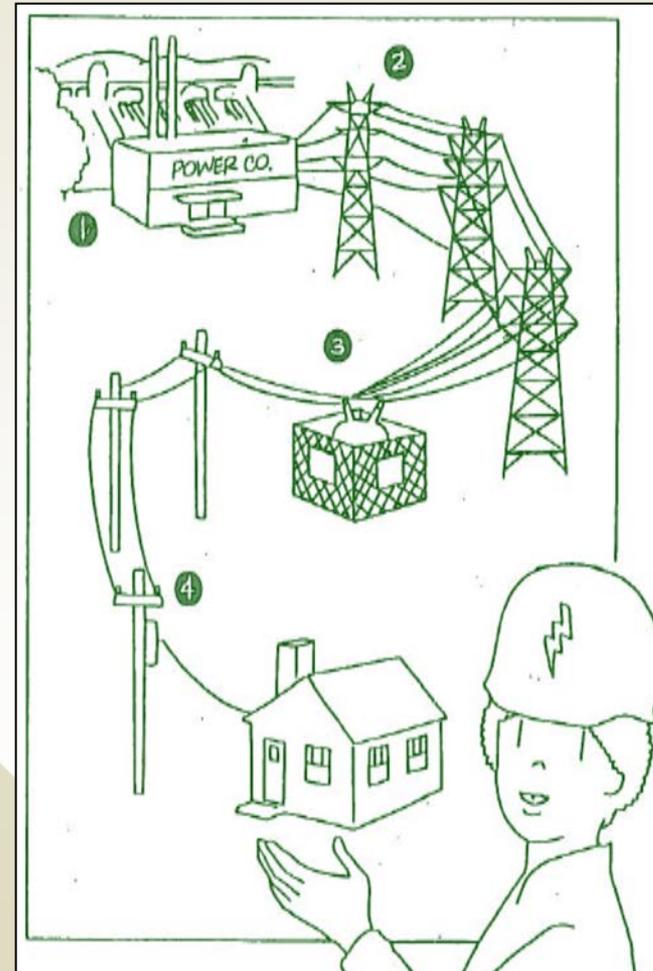
The system is a coast-to-coast “grid” of high-voltage transmission lines.

3. Substation Transformers “Step Down” The Voltage

This allows local distribution systems to carry electricity over their power lines.

4. Pole Transformers Step Down The Voltage Once More

Electricity can then safely enter your home or business on demand.



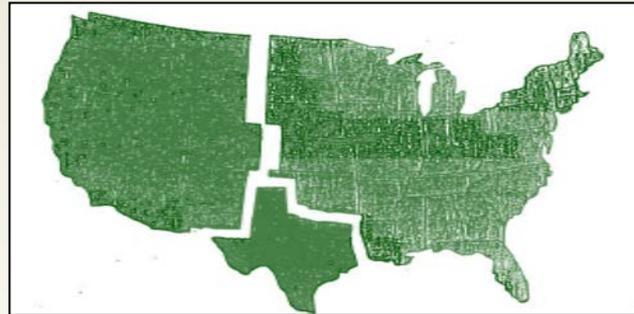
Demands for electricity
change by the minute!





3 Major Grids Connect Most Utilities

1. The Eastern grid links the East Coast and Plains states
2. The Western grid connects the Pacific Coast and Mountain states.
3. The Texas grid services Texas.

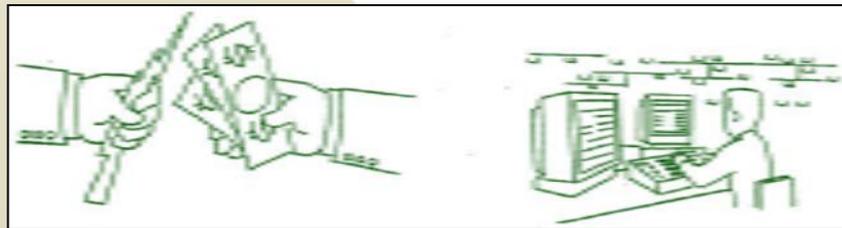


Utilities Make Power Sharing Agreements

They agree to buy and sell power from one another. They also agree to carry one another's power over their lines.

Computers Monitor Demand and Power Flow

As demands change, utilities may decide to generate more or less power, or to buy and sell power.



The transmission system is dependable and efficient. It's designed to meet our country's changing needs!



Electricity And The Environment

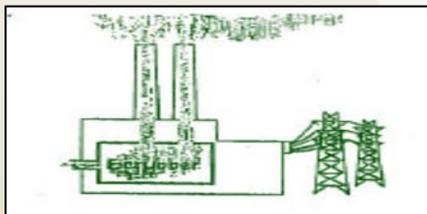
Electric utilities spend billions of dollars each year to balance the needs of affordable energy and a clean environment. For example:

Emission Controls

For coal—and oil-fired power plants, special filters and scrubbers:

Remove ash from emissions
Reduce sulfur dioxide (SO₂) and nitrogen oxide (NO) emissions.

Many utilities also burn “low-sulfur” coal to reduce SO₂ emissions.



Environmental Management

Electric utilities run many programs to protect wildlife, lakes, streams and other wetlands. And, they work to restore land affected by mining.



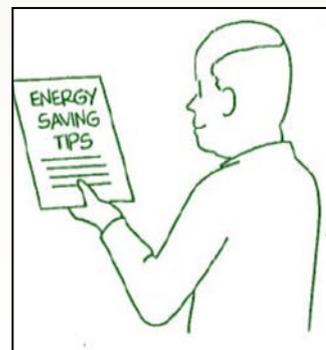
Cleaner Burning Technologies

New ways of burning coal can greatly lower emissions—and improve energy-efficiency.



Energy Efficiency Programs

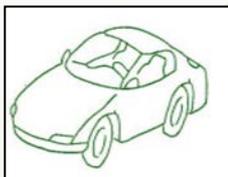
By helping customers be more efficient, electric utilities can better manage demand and reduce emissions.





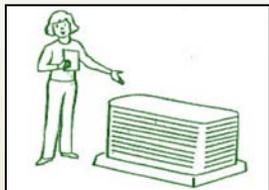
New Electric Technologies

These products are highly energy-efficient, “environmentally friendly”—and available today. For example:



Electric Cars

Use significantly less energy than gas-powered cars. This greatly reduces operating costs—and air and water pollution.



High-Efficiency Heat Pumps

“pump” heat from the outside into your home in the winter (even cold air has heat). In the summer, they “pump” heat out to cool it.

Super-Efficient Home Appliances

Include:

- microwave clothes dryers.
- horizontal axis clothes washers
- refrigerators
- electric barbecue grills
- cordless electric lawnmowers.



High-Efficiency Light Bulbs

Use a lot less electricity than ordinary bulbs. They also last much longer.

For more information about these products, contact your local electric utility.





Do You Use Electricity Efficiently and Safely?

To find out, complete these checklists:

Efficiency Checklist

Do you:

1. Turn off lights and appliances when not in use?
2. Buy appliances with high energy-efficiency ratings?
3. Set your air conditioner thermostat at the highest comfortable setting?
4. Set your heating thermostat at the lowest comfortable setting during the day, and lower it at night?
5. Do full loads when using the washer, dryer or dishwasher?
6. Use energy-efficient light bulbs?
7. Avoid preheating the oven?
8. Keep power tools and electric appliances clean and properly maintained?
9. Set your water temperature to 120F (or, if you own a dishwasher, to the temperature recommended by the manufacturer)?
10. Use major appliances during "off-peak" hours, when demand—and costs—may be lower?



If you answered "No" to any question, you could be more energy-efficient. For information about home-energy surveys and audits, call your local utility.





Do You Use Electricity Efficiently and Safely?

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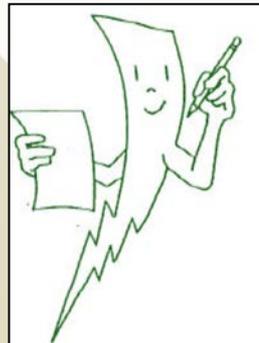
Safety Checklist

Do you:

1. Inspect cords regularly, and replace damaged or worn cords promptly?
2. Inspect your home for the fire hazards and take steps to eliminate them promptly?
3. Use electrical appliances or power tools if your hands are wet or you're standing on a wet surface?
4. Unplug appliances before cleaning them?
5. Pull the plug, not the cord, when disconnecting it?
6. Keep away from power lines when working outdoors, especially if using a ladder?
7. Have outlets in potentially wet areas (bathrooms, kitchens, outdoors, etc.) protected by ground-fault circuit interrupters (GFCIs)?
8. Know what to do in an electrical emergency (fire, downed wires, power outages, etc.)?
9. Call your local utilities to locate underground wires and other hazards before you dig?
10. Teach young children basic electrical safety rules, (for example, not to put their fingers into outlets)?

Any "No" Answers

mean you need to take action to be safer!
For safety information, call your local utility
or fire department.





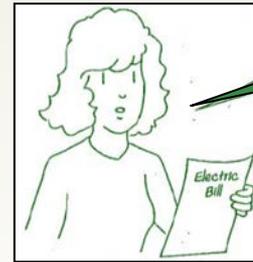
Questions and Answers

How many different types of electric utilities are there?



- There are many, including:
- investor-owned “private” companies
 - community-owned “public” utilities
 - federal power projects
 - rural electric cooperatives (RECs)

The “watt” is the basic unit for how much electricity is produced or used. A “kilowatt” (kW) equals 1,000 watts. “Kilowatt-hours” (kWh) are the number of kilowatts used for one hour.



What is a Kilowatt?

Why can birds sit on power lines?



Electricity always seeks a path to the ground. Since birds are not grounded (touching the ground), electricity has only one path to follow—the power line. (Never touch a power line!)





Electricity Is Energy You Can Depend On!

- ✓ **Always Use Electricity Wisely**

--safely and efficiently.

- ✓ **Learn More**

about electricity and the environment, especially new electric technologies.

Electricity—power for today and tomorrow!

