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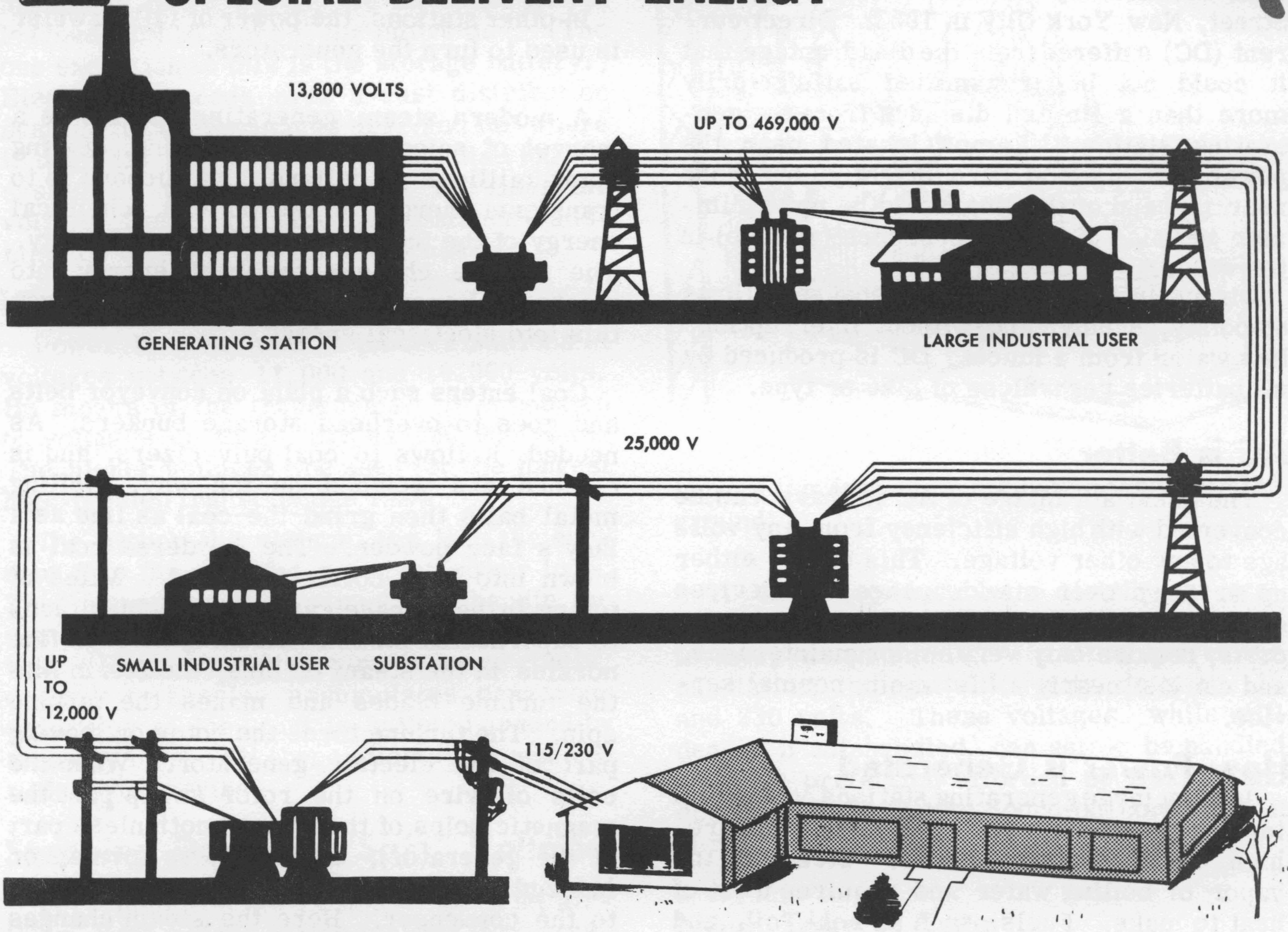
SPECIAL DELIVERY ENERGY



How are most of the things you use in your home delivered to you? Do they come by truck, or do you go and get them in the family car?

How about the limitless supply of electrical energy--how is it delivered?

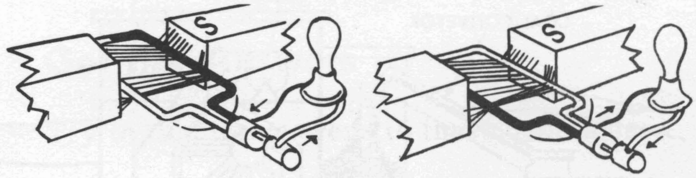
Today most people take for granted the system that brings power to their homes. They know that all they have to do is flip a switch and a mysterious, almost magical force provides light when it's dark, heat when it's cold, and "cold" when it's hot. You'll find it interesting to know how electricity is made and how it is delivered to you. You'll find it valuable to know what to do if the supply ever should fail.

What to Do

1. Get to know the system that delivers electrical energy to your home.
2. Learn what to do if your power supply is interrupted.

How Our "AC" is Made

Practically all electricity produced for sale in the United States is now "alternating current." This is usually abbreviated AC so that it can be spoken and written easily.



When a loop of wire spins between the poles of a magnet, it cuts magnetic lines of force. This produces an electric current in the wire. The current reverses direction each half turn and is therefore called alternating current. The first alternating current system lighted the town of Great Barrington, Massachusetts on March 20, 1886 and was developed by George Westinghouse.

DC is Older

Previously, a direct current generator had been installed by Thomas Edison at Pearl Street, New York City in 1882. Direct current (DC) suffered from the disadvantage that it could not be transmitted satisfactorily more than a limited distance from the generating station. Lamps located near the power house would burn brightly, but those near the end of the line would be much dimmer because of loss of pressure (voltage) in the wires.

Direct current is so called because it flows smoothly, evenly, and without interruption, like water from a faucet. DC is produced by all batteries regardless of size or type.

AC is Better

The great advantage of AC is that it can be converted with high efficiency from any voltage to any other voltage. This can be either up or down over a wide range, by devices called transformers. They have no moving parts, require only very minor maintenance, and can last nearly a lifetime in normal service.

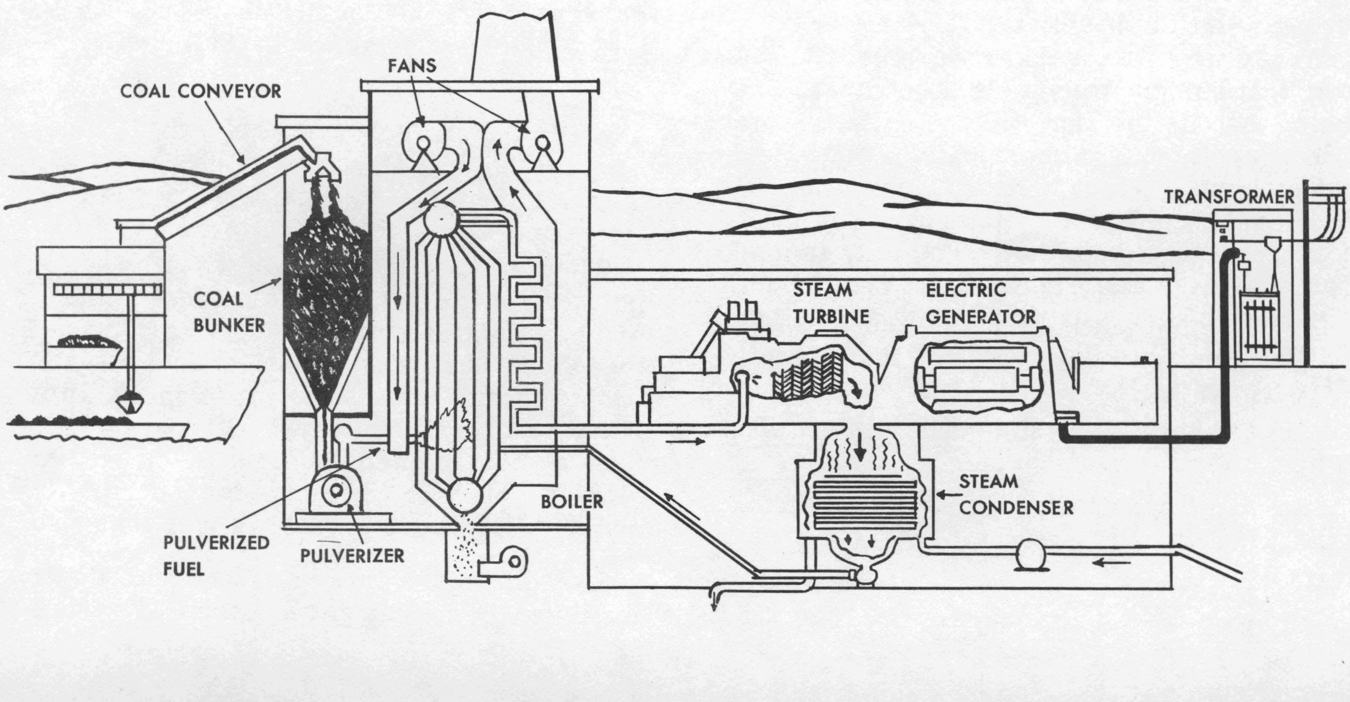
How Power is Generated

In most large generating stations, the actual turning power is provided by high-pressure, high speed steam turbines. Steam is the vapor of boiling water and requires a lot of heat to make. Fuels, such as coal, oil, and gas, are used to keep huge boilers steaming 24 hours a day. Already atomic power is starting to replace these fuels.

In other stations, the power of falling water is used to turn the generators.

A modern steam generating station is a marvel of science and engineering, costing many millions of dollars. Its purpose is to transform energy. In the boilers, chemical energy of the fuel is changed to heat energy. The turbine changes the heat energy into mechanical energy. The generator changes this into electrical energy.

Coal enters such a plant on conveyor belts and goes to overhead storage bunkers. As needed, it flows to coal pulverizers, and is cleaned and weighed on the way. Rolling metal balls then grind the coal as fine as a lady's face powder. The powdered coal is blown into huge boiler-furnaces. Miles of tubing in the furnace carry water which turns to superheated steam. Rushing through fine nozzles in the steam turbine, the steam hits the turbine blades and makes the turbine spin. The turbine turns the rotor or moving part of the electric generator. When the coils of wire on the rotor sweep past the magnetic poles of the stator (motionless part of the generator), electricity is formed or induced in the wires. Steam now goes back to the condenser. Here the steam changes back to water and returns to the boiler to start its trip once more.



Transforming Power

Electricity must be used the instant it is made. In other words, we have not as yet learned how to store it for future use. (The one exception to this is the storage battery.) Electricity speeds over a vast distribution system to all the places near and far where it does its work. Heart of the distribution system is the transformer. It raises the voltage of electricity for long-distance transmission or lowers it for many uses.

High Voltage Highway

Power is generated in modern stations at voltages between 11,000 and 14,000 volts. By means of the transformer, it is boosted to voltages up to as high as 460,000 volts. The higher voltages are used for the longest high-tension transmission lines.

The higher the voltage, the less the current flow (amperes) for a given power load. This means smaller wires can handle the same load. This is an important consideration. Large diameter wire is more costly, difficult to handle, accumulates dangerous quantities of ice, and is buffeted around by strong winds. All these effects are reduced with smaller wire.

Stepping Down to "Safe" Voltages

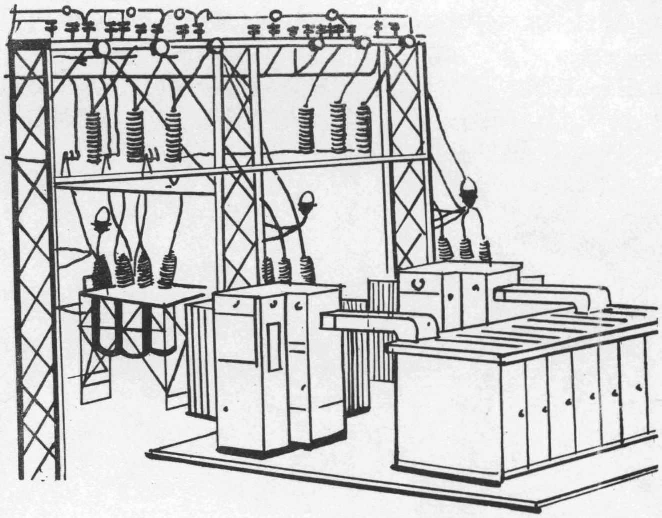
Very high voltage is much like a jet airliner. Such a plane is fine for long distances, but you can't land it in your backyard. You have to "step down" from the plane at a big airport, either to a smaller plane or to an automobile, to complete your trip.

Electricity, on its way to you, does the same thing. It steps down at least twice from the high voltage of the transmission line.

The first step-down takes place at a substation, where there are transformers, circuit breakers, and lightning arresters. From here the electricity goes over distribution lines to the surrounding area at a voltage that, although still high, is much safer to "have around" than that used for transmission.

The circuit breakers are giant automatic switches which turn off the electricity in case of an emergency. They turn it on again when the emergency is over.

Lightning arresters protect electrical equipment when lightning hits the line. They



bypass the extra current harmlessly into the ground.

The final step-down in the distribution system is near your home. Here another transformer, much smaller than the one at the substation, brings electricity down to 115 and 230 volts. These voltages, while still deadly if mishandled, can safely be handled with the protection afforded by flexible and economical insulation found on cords and in our appliances.

Now, Take a Tour

Ask your leader to organize a tour of a local power supplier's generating plant or substation. Arrange to have a power supplier representative explain the purpose of the various pieces of equipment.

Get the Answers

Try to find the answers to these questions:

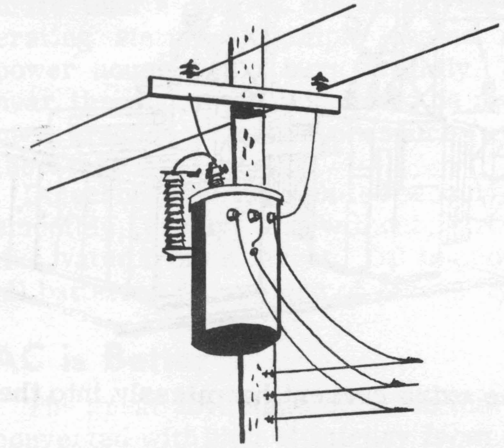
Where is the power you use generated? How is it made (steam or water power)?

What about the power line past your home --what is its voltage?

Where is the substation from which your line is fed?

Is there more than one way that the line past your home can get electricity? Why?

Where is the transformer that serves you? Does it serve other customers, too? How many? See if you can find out what size it is (in "KVA's" which are almost the same as kilowatts). What is the load connected to this transformer? Why can it handle a load of this size?



When the Power Goes Off

The power system has yet to be operated that does not stop delivering electricity at some time or other. Power suppliers take every possible precaution against this, yet they are prepared to act quickly, if necessary, to restore service at any hour of the day or night.

When and if yours does, there will always be a good reason. Some of these are:

1. "Planned" interruptions. Your power supplier from time to time has to shut off certain customers because of necessary repairs and improvements to the line. Most power suppliers attempt to protect their customers from loss or inconvenience from such interruption by scheduling them at times when power use is down. They also try to notify users by telephone, in person, or by newspaper and radio.

2. Weather. Thunderstorms, ice storms, and windstorms can cause plenty of damage to even the best-protected lines.

3. Accidents. A car can shear off a pole, or a careless woodsman can fell a tree across a power line. Other accidents can produce the same effect.

WARNING: If you see a fallen wire or any other evidence of an accident, call the police or power supplier immediately.

4. Equipment failure. Despite every precaution, somewhere along the line a piece of equipment may break down and put you out of power.

Your Responsibility

If some day your power supply fails, here is what you should do:

1. Make sure that the interruption is not just caused by the blowing of your own main fuse.

2. Telephone your power supplier immediately. Give them your name and location, and information as to when the interruption occurred. (IMPORTANT--Some people who have depended on the "other fellow" to do this have waited for days and wondered why their service was not restored. Power suppliers depend on you for this--they have no other way of knowing whether all their customers are "in service.")

Make sure you know where to call to get in touch with your power supplier--day and night.

What Did You Learn?

True or False

1. Practically all commercially produced electricity in the United States is generated as direct current and converted to AC.
2. Direct current can be transmitted greater distances than AC.
3. Planned interruptions, weather, accidents, and equipment failure are the main causes of power failure.
4. Coal is pulverized to a fine powder before it is fired in large steam boilers.
5. Electricity can not be stored except chemically in a storage battery.

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