OTHER SOURCES OF ELECTRICITY

Generators can make electricity by applying electromagnetism, as we know from Faraday's discovery.

Here are other ways electricity is made:

static electricity

is made when certain types of materials such as your hair and a comb rub together and produce friction.

atmospheric electricity,

a form of static electricity, is generated when heat differences occur in certain clouds called thunderheads. Atmospheric electricity is often discharged in the form of *lightning*.

current electricity

also is made by chemical action when dissimilar metals are immersed in certain liquids or gases. Automobile batteries are an example. Dry cell batteries also produce current.

Scientists have found new ways to make electricity, such as heating metal in a vacuum or speeding high pressure gas through a magnetic field. But until these methods are perfected, the electromagnetic generators used in power plants today are still the best source for the tremendous quantities of electric power we need.

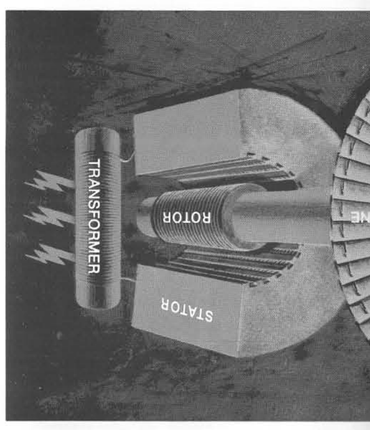
Winter snow survey at Blue Lakes. In this April 1, 1969 measurement, the snow core picked up with the tubular metal instrument contained a record 66.3 inches of water. The 50-year average here is 35.6 inches of water on April 1. PG&E shares snow survey information with state and local water agencies.

YOU AND YOUR METER

The electric power that comes into your home goes through a meter, the clock-like glass box on an outside wall or in the basement of your home. It measures the amount of energy you use. A PG&E meter reader checks your meter once a month and records the amount of electricity used.

From the meter, the electricity goes to a *fuse box* or a *circuit breaker*. A fuse is a small strip of soft metal in a plug. If too much electric current passes through this metal strip, the strip melts and shuts off the electricity. Excess electric current is usually caused by an overloaded house circuit, a defective appliance or inadequate wiring. Fuses for ordinary lights and wall plugs should be no larger than 15 amperes.

In a circuit breaker, too much current coming through the wires will shut off a switch instead of blowing out a fuse. When the trouble is corrected, you simply flip the circuit breaker switch back on.



Lake Britton Picnic Area above is one of 48 company picnicking and campground facilities in the Cascade Range and the Sierra Nevada. They are located on company property next to reservoirs and streams. Several hundred thousand Californians enjoy these facilities every year. Ask PG&E for the descriptive folder: "Your Guide to PG&E Campgrounds and Picnic Areas."

ABOUT PG&E:

Today, PG&E serves more than 5.6 million customers in 48 California counties. To keep pace with increasing energy demands, PG&E spends nearly $2.5 million each working day in new construction. No other industry requires the capital outlay of electric utilities.

PG&E employs nearly 25,000 Californians and operates 76 electric generation plants and 95,000 miles of transmission and distribution lines; 32,000 miles of gas lines carry more than 611 billion cubic feet of fuel annually. Five sources of energy are tapped to generate electricity: oil, natural gas, nuclear energy, falling water, and geothermal steam. The electric system capability is rated at 13 million kilowatts.

PG and E

Pacific Gas and Electric Company

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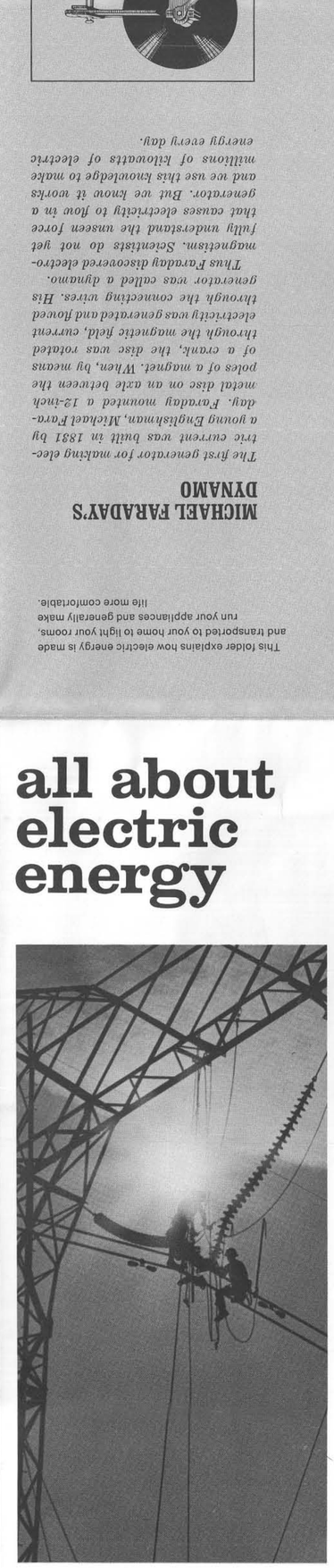
all about electric energy



This folder explains how electric energy is made and transported to your home to light your rooms, run your appliances and generally make life more comfortable.

the generator

Faraday's dynamo weighed but a few pounds. We wonder what he would say if he could see today's generators that weigh as much as 600 tons. Despite their huge size and many complex parts, they use the same principle as Faraday's dynamo.

The generator has two basic parts: the *rotor* and the *stator*.

The rotor is a giant electromagnet that spins inside the stator. It corresponds to Faraday's permanent magnet.

The stator is a stationary part surrounding the rotor and containing many coils of heavy copper wire.

When the rotor spins inside the stator an electric current is set up in the stator coils.

MICHAEL FARADAY'S DYNAMO

The first generator for making electric current was built in 1831 by a young Englishman, Michael Faraday. Faraday mounted a 12-inch metal disc on an axle between the poles of a magnet. When, by means of a crank, the disc was rotated through the magnetic field, current electricity was generated and flowed through the connecting wires. His generator was called a dynamo.

Thus Faraday discovered electromagnetism. Scientists do not yet fully understand the unseen force that causes electricity to flow in a generator. But we know it works and we use this knowledge to make millions of kilowatts of electric energy every day.

FUEL BOILS WATER ▮ STEAM DRIVES TURBINE ▮ TURBINE DRIVES GENERATOR ▮ TRANSFORMER BOOSTS VOLTAGE

the turbine

The turbine's job in a power plant is to spin the rotor.

The turbine has a long shaft with many blades that receive the force of jetting steam or falling water. This force spins the shaft and also rotor of the generator which is connected to the other end of the shaft.

The turbine does the same job as the crank on Faraday's dynamo.

Since the turbine and generator are connected, we often refer to them as the turbine-generator or turbo-generator.

A huge amount of energy is needed to spin a heavy turbine-generator at thousands of revolutions per minute for hours and days at a time. So now it's important to know something about the kinds of energy, or power, we use to spin turbine-generators.

STEAM ENERGY

As you know, if you boiled water in a tea kettle with the spout stopped up so the steam couldn't get out, the kettle would blow up with a bang. That's because when water turns to steam, it takes up more room—it expands.

But if you put a narrow pipe on the kettle and let the steam shoot out the end, you could make the steam pressure turn a wheel.

That's basically what happens in a steam power plant. A large boiler—sometimes 20 stories high—boils water in hundreds of miles of pipe. The water becomes steam which is piped under great pressure to the turbine.

PG&E's biggest power plants use steam; we call them steam-electric power plants.

Most steam power plants in the United States boil the water by burning coal. In California, however, oil and some natural gas are burned because here these fuels are more available than coal. PG&E, like many other energy companies, is turning to nuclear fuel. Nuclear fission makes the steam instead of fossil fuel.

PG&E has an unusual power plant, The Geysers, which uses Mother Nature's own steam from below the earth—no man-made boiler is needed! After wells are drilled, the escaping natural steam is piped directly to the turbine-generator. For more information, ask PG&E for the pamphlet "The Geysers".

NUCLEAR ENERGY

An increasing number of steam power plants in the United States and other countries use uranium. In these plants uranium atoms are caused to split in what is called a chain reaction. When atoms are split they give off a great amount of heat, which is used to turn water into steam. From this point, nuclear energy plants work just like other steam-electric plants.

PG&E has a nuclear power unit at Humboldt Bay near Eureka. We've built two more at Diablo Canyon on the San Luis Obispo County coast that await government approval to operate. For more information, ask for the pamphlet "Nuclear Power From Diablo Canyon."

WATER ENERGY

You are familiar with the force of water spurting from the nozzle of a garden hose. This force is created because water stored in a reservoir at higher elevation than your home creates pressure.

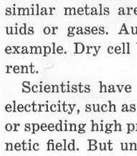
PG&E has 64 powerhouses in the mountains that capture the force of falling water to spin turbines.

These hydroelectric powerhouses usually are located in canyons below reservoirs. Water from a reservoir flows through a tunnel or a canal to a point high above the powerhouse, then plunges down through a large pipe called a penstock. The water spurts through a nozzle and hits the blades of the water wheel (turbine) with great force.

We have as many as nine powerhouses on one river using the same water over and over again at successively lower elevations.

After the lowest powerhouse uses the water it flows on to towns and farms for drinking and irrigation.

POWER LINES



After electricity is generated, it goes to *transformers* outside the powerhouse.

The transformer's job here is to *raise* the voltage. High voltage provides the "push" that sends the power on its way as much as several hundred miles. Some lines carry voltage as high as 500,000 volts.

Thick wires called *transmission* lines, mounted on tall steel towers, carry the high-voltage electricity to substations in or near points of use.

Here transformers *lower* the voltage for distribution lines. The wires in your neighborhood carry 12,000 volts typically. Transformers on poletops or in underground vaults lower the voltage again for household use.