

# Electricity Generation

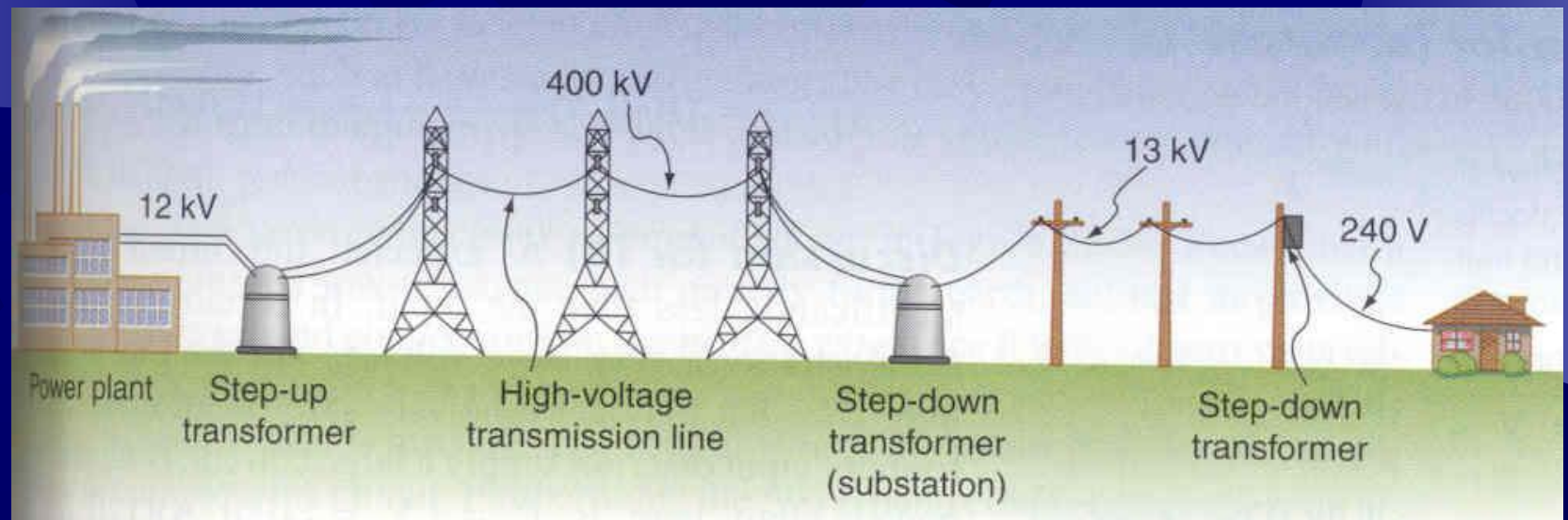


# Today we will explore electrical energy, better known as electricity

## So What Exactly Is Electricity?

Electricity by definition is electric current that is used as a power source!

This electric current is generated in a power plant, and then sent out over a power grid to your homes, and ultimately to your power outlets.



# So How Is An Electric Current Generated?

Electric current generation - whether from fossil fuels, nuclear, renewable fuels, or other sources is usually based on the:

## Simple Equation For Electricity Generation



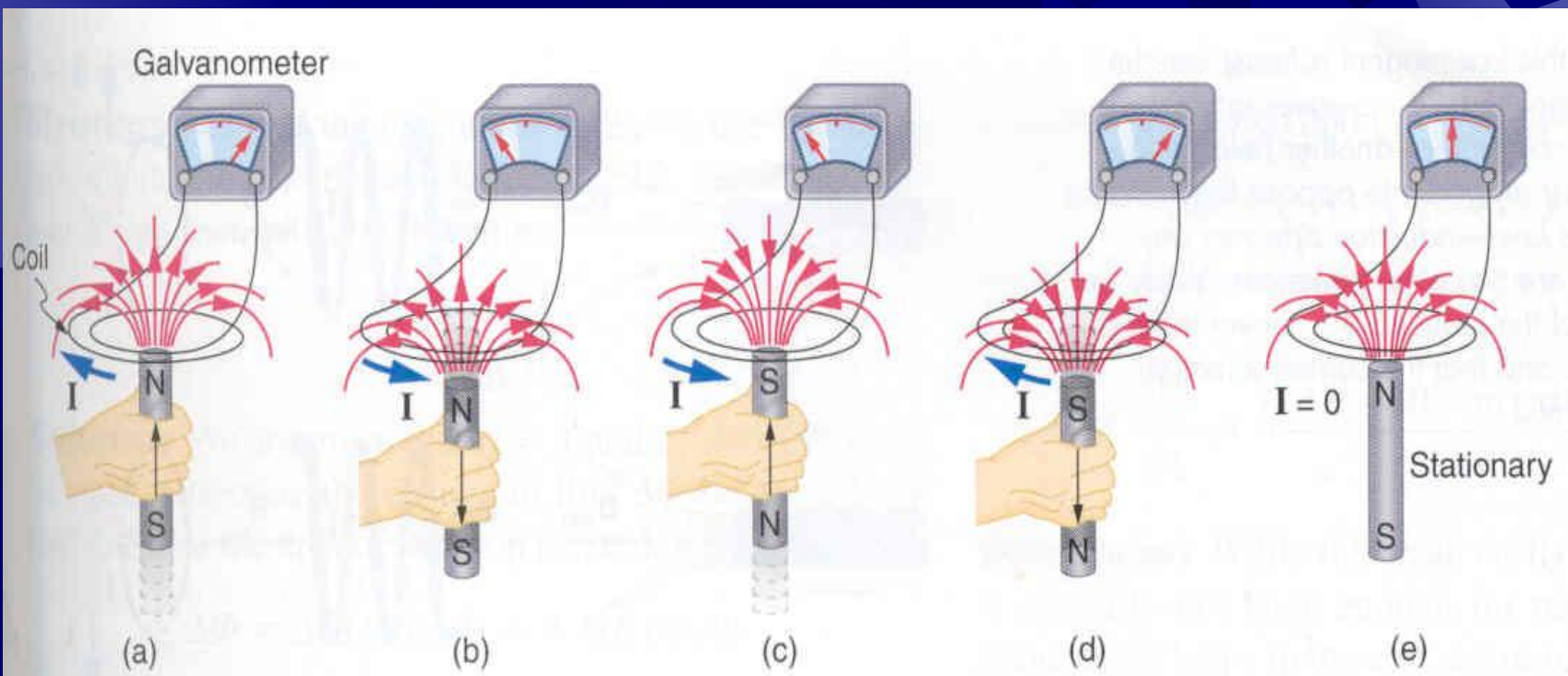


# Motion is Essential

If you place a magnet and a conductor (copper wire), in a room together there will be no electric current generated.

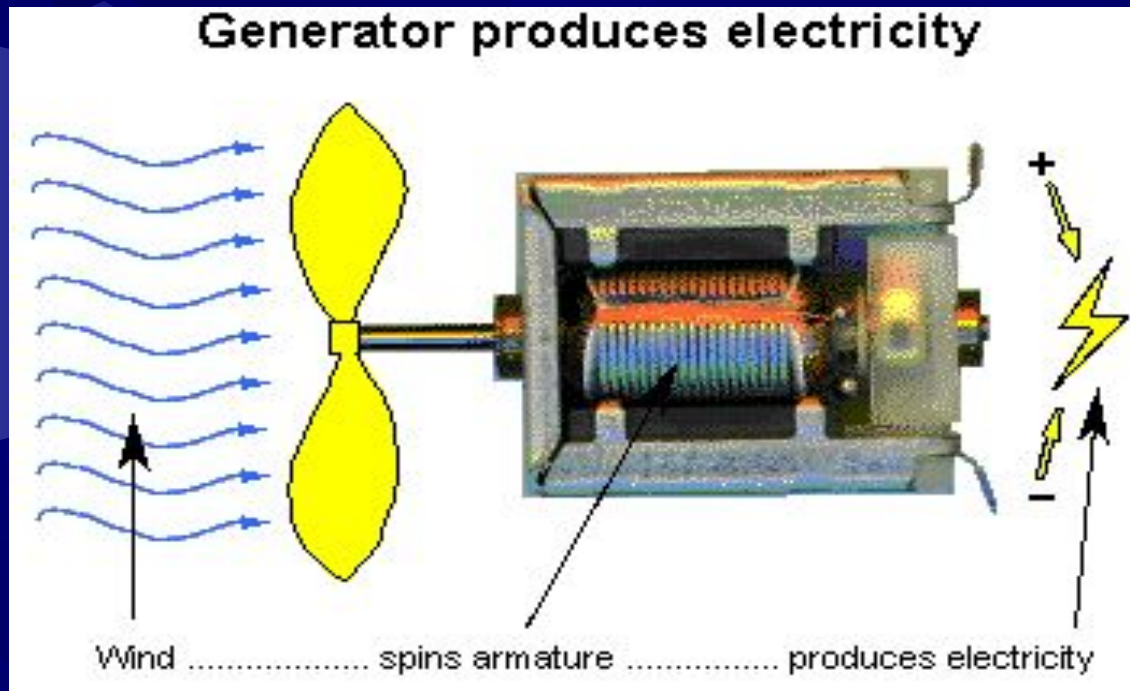
This is because motion, from our equation for electricity, is missing!

An electric current is not generated unless the magnetic field is moving relative to the copper wire, or the copper wire is moving relative to the magnetic field.



# Simple Electric Generator

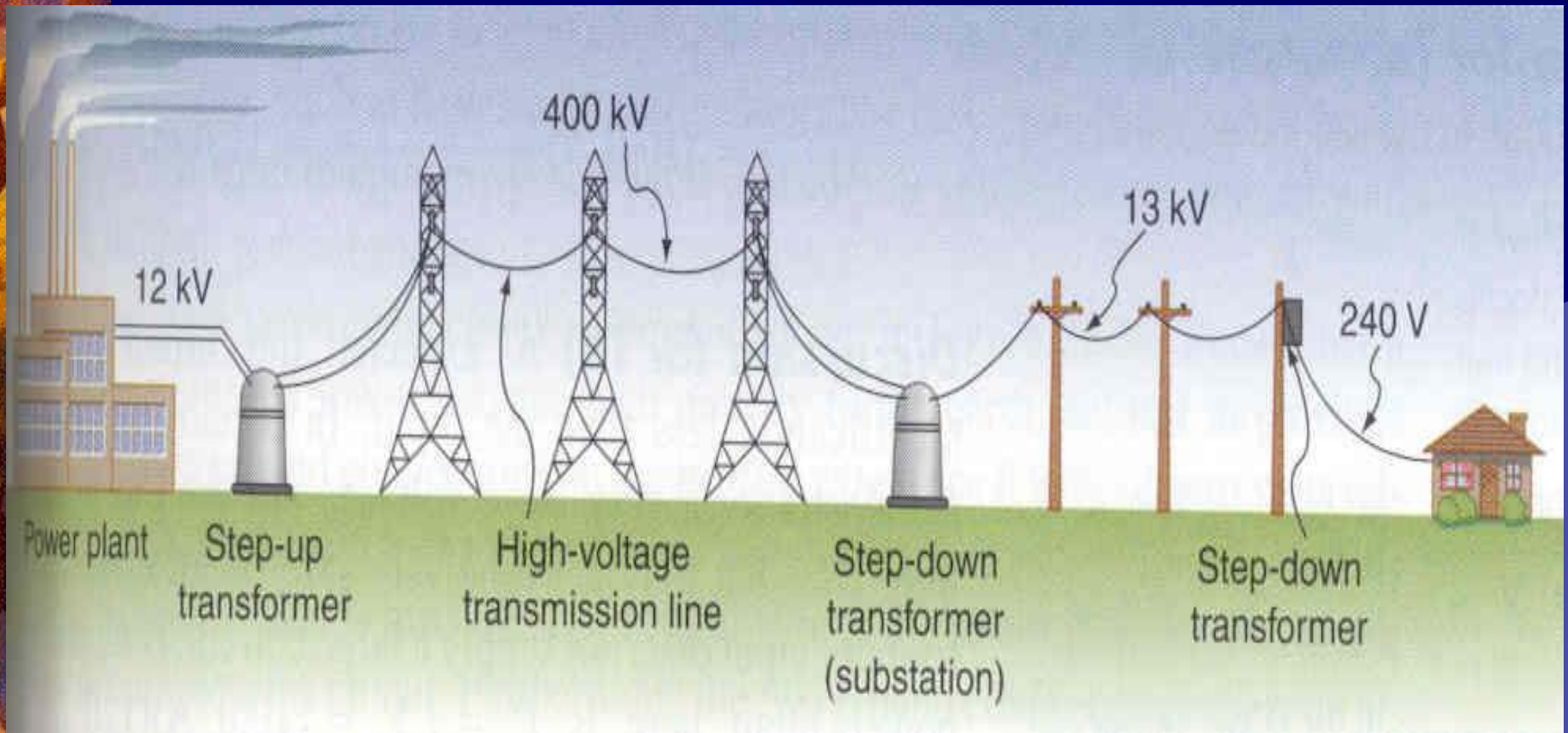
So simple electric generators found in power plants contain, magnets and copper wire that when put into motion relative to one another create the electric current that is sent out to homes.



The major problem in electricity generation is where does the Motion come from that keeps the copper wire and magnets moving relative to one another.

In this case, wind power applies a force to the blades that turns them. The spinning blades, spin an armature that turns the copper wire relative to the magnetic field. As long as the blades spin, electricity will be generated!

# Electricity Transmission



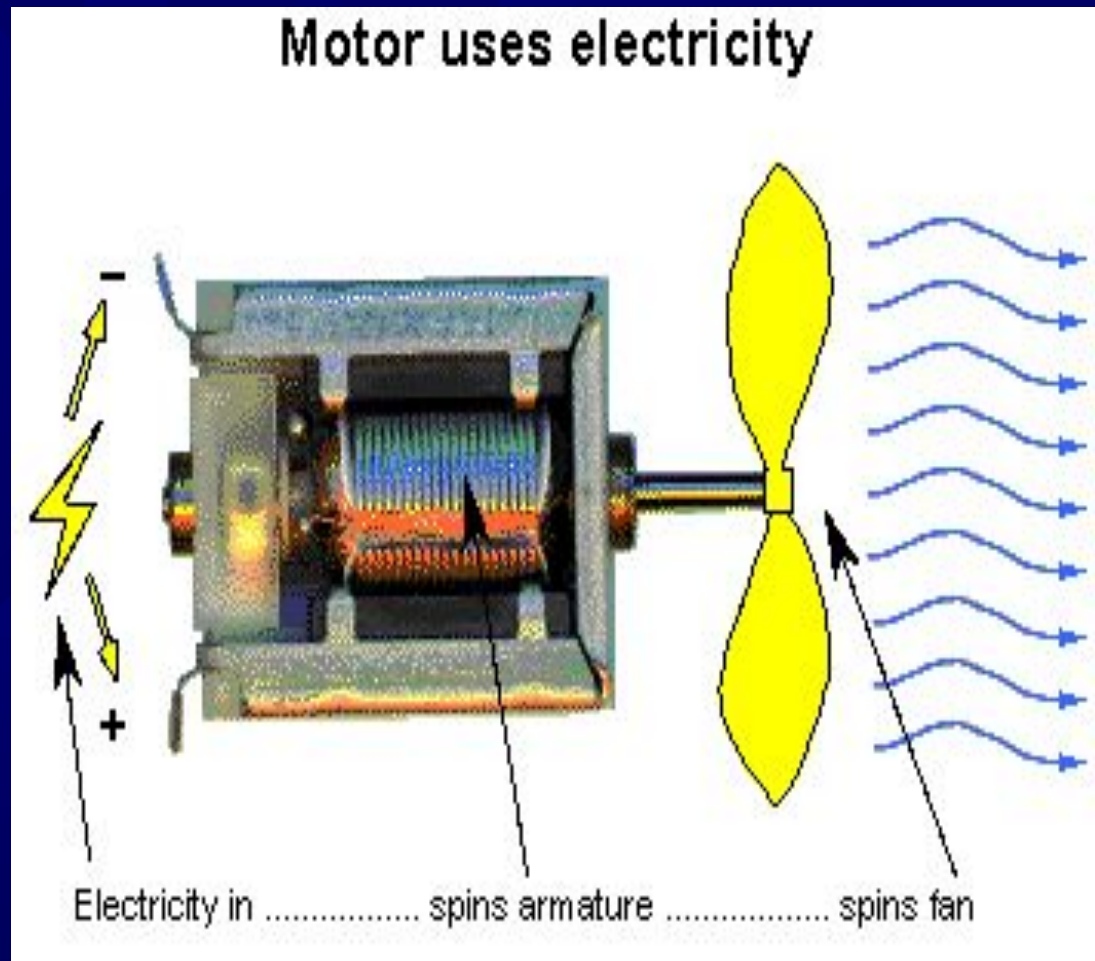
- AC of 60 Hz produced by generator
- Resistance losses are smallest at high voltages and low currents



# What Happens At Home?

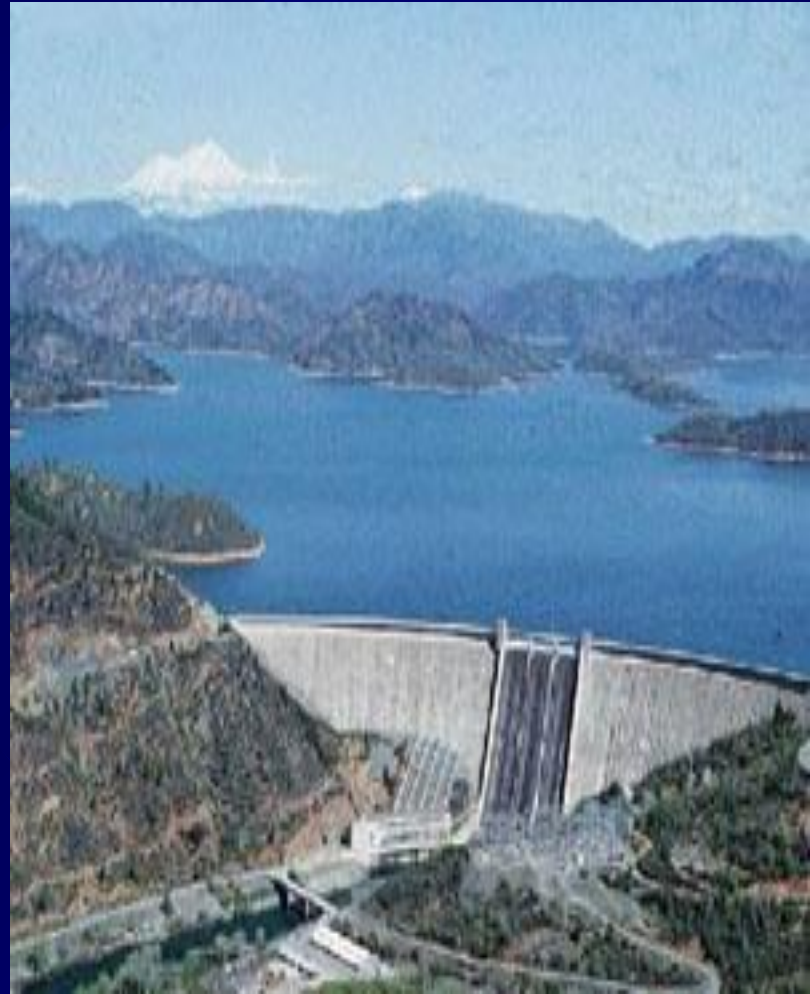
At home, electric current that was generated by generators in the power plant is used to power electric appliances.

The electric current, running through the copper wire causes the armature to spin which is how most motors generate motion.



# Hydroelectric Power

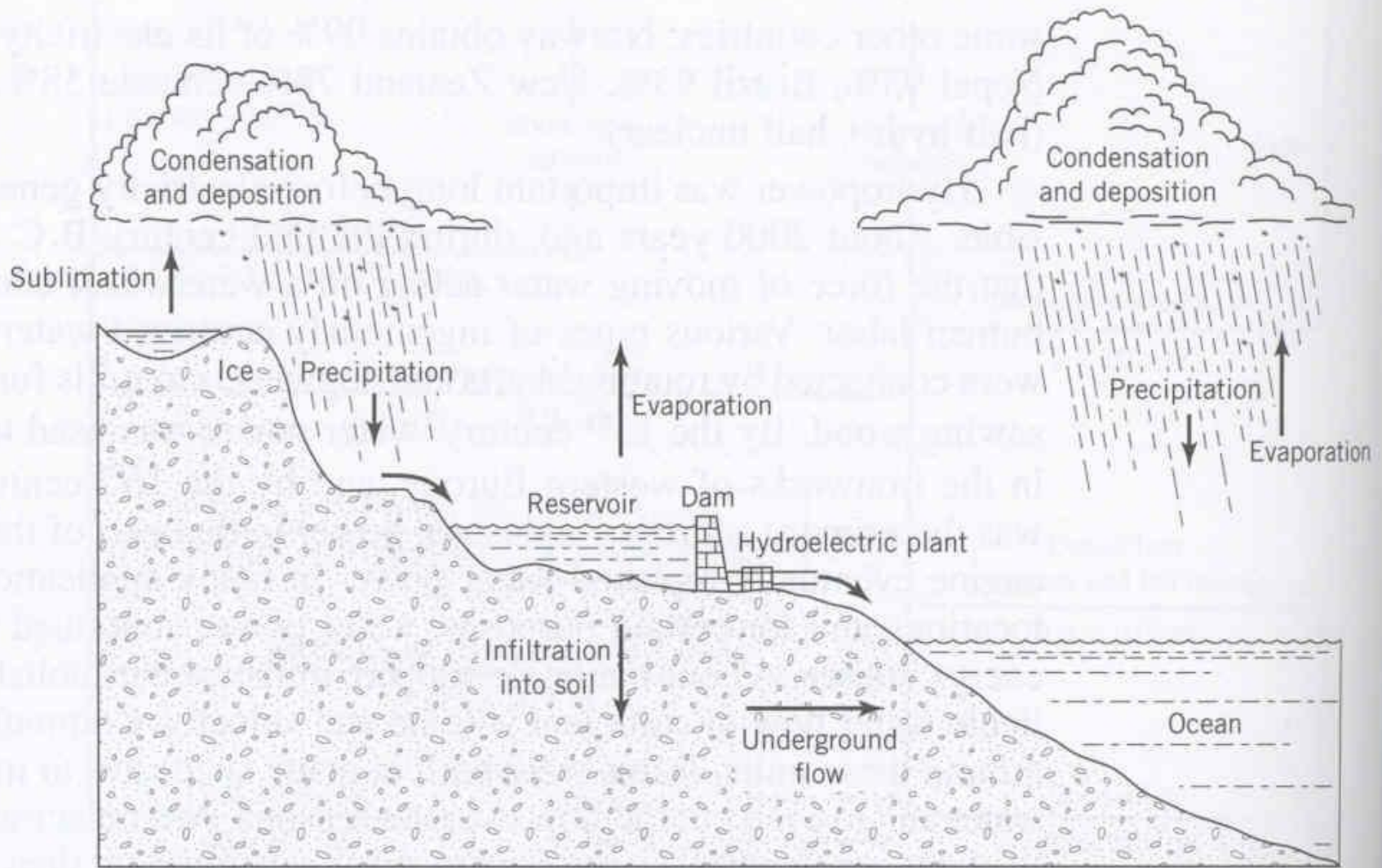
- Conversion from potential energy of water to electric energy is at 80 – 90% efficiency
- Hydroelectric projects in the United States have rated capacities from 950 – 6480 MW
- The use of Water Power is much greater in some other countries. Norway obtains 99% of its electricity from water power. Nepal, Brazil, and New Zealand are close seconds.

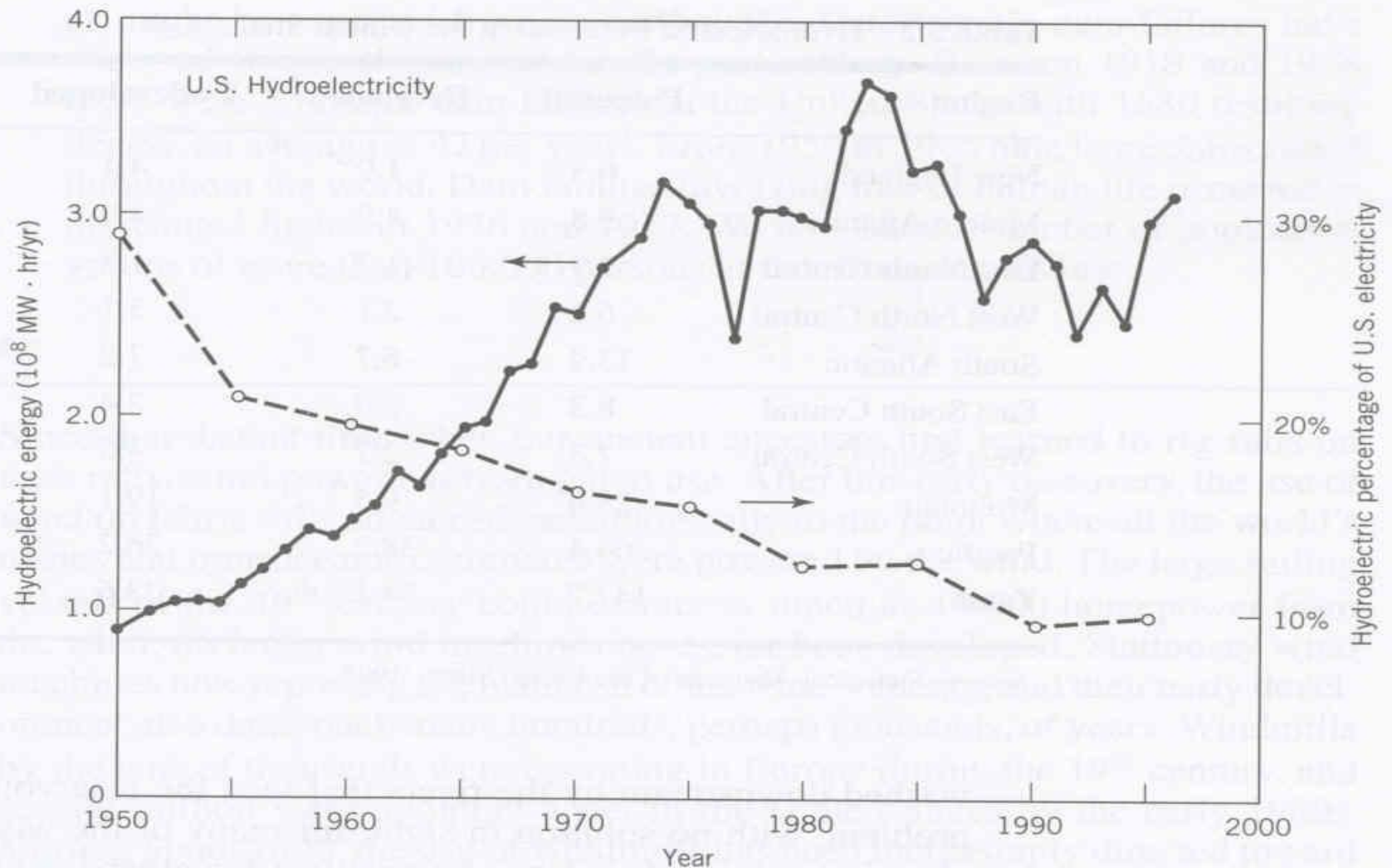


Water generated - Hydroelectric Shasta Dam In California



# The Hydrologic Cycle



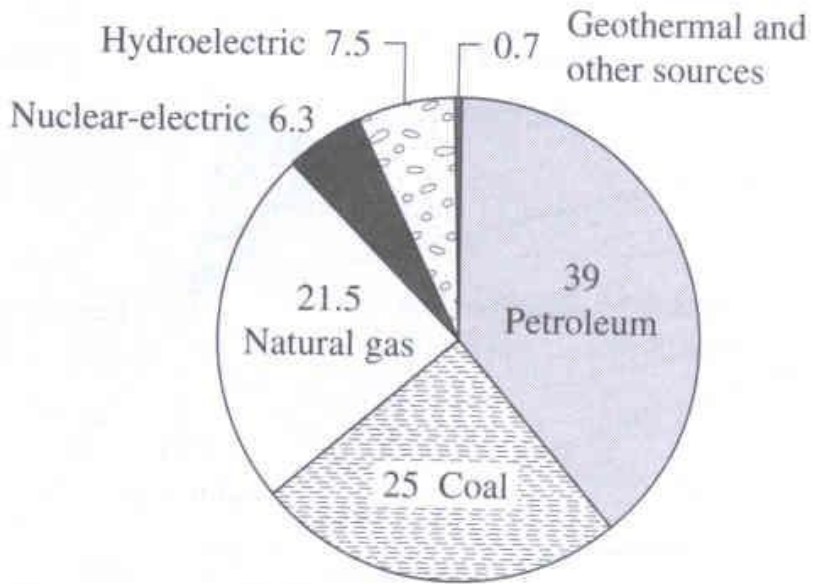


- Hydroelectricity has dropped from producing 30 % to 10% of US electricity
- Large fluctuations in output are mainly due to variable rainfall totals

# Other Energy Considerations

- Solar Power – uses the sun energy to either boil water or directly converts solar energy to electrical energy
- Ocean Thermal Energy Conversion – uses temperature differences between different depths of ocean water to drive a heat engine. Working fluid is ammonia which is gas at room temperature.
- Biomass Energy: Municipal Solid Waste – burning wastes to drive heat engines
- Geothermal Energy – based on naturally occurring heat in the Earth in the Earth due to radioactive decay
- Tidal Energy – uses the gravitational pull of the moon on our oceans to drive turbines





Proportion of World's energy consumption - 1997

Proportion of the world's Electricity generation - 1997

