# GENERATION OF ELECTRICITY

*Subject Name: Electrical Fundamentals*

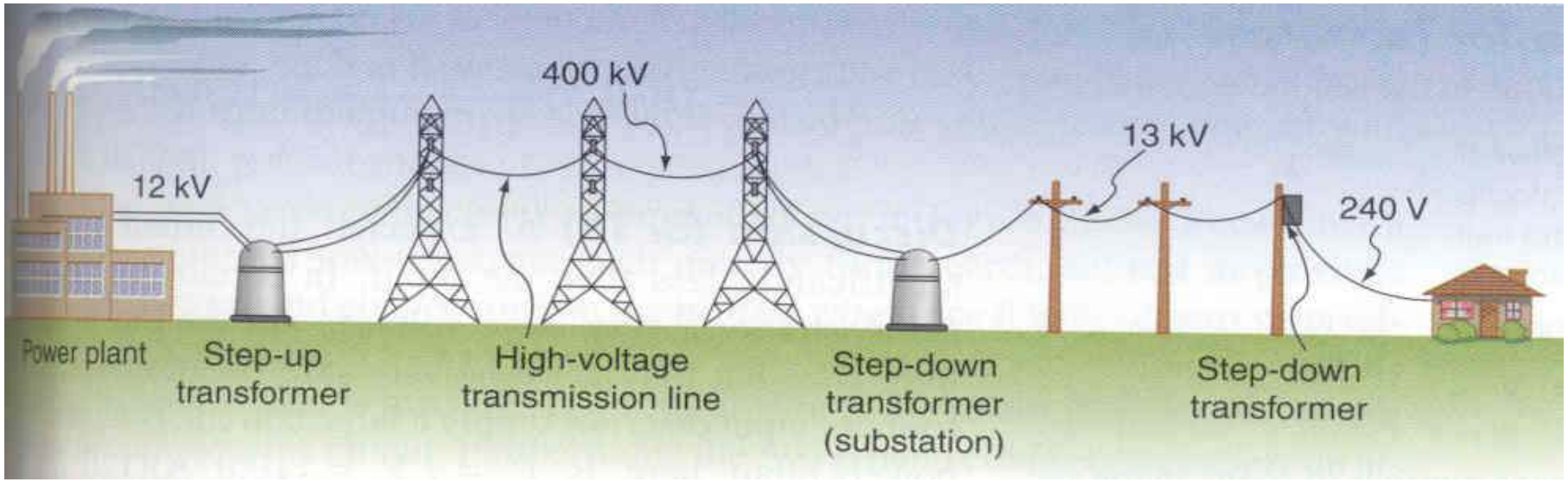
Prepared By:
Nikesh I Patel

Approved By:

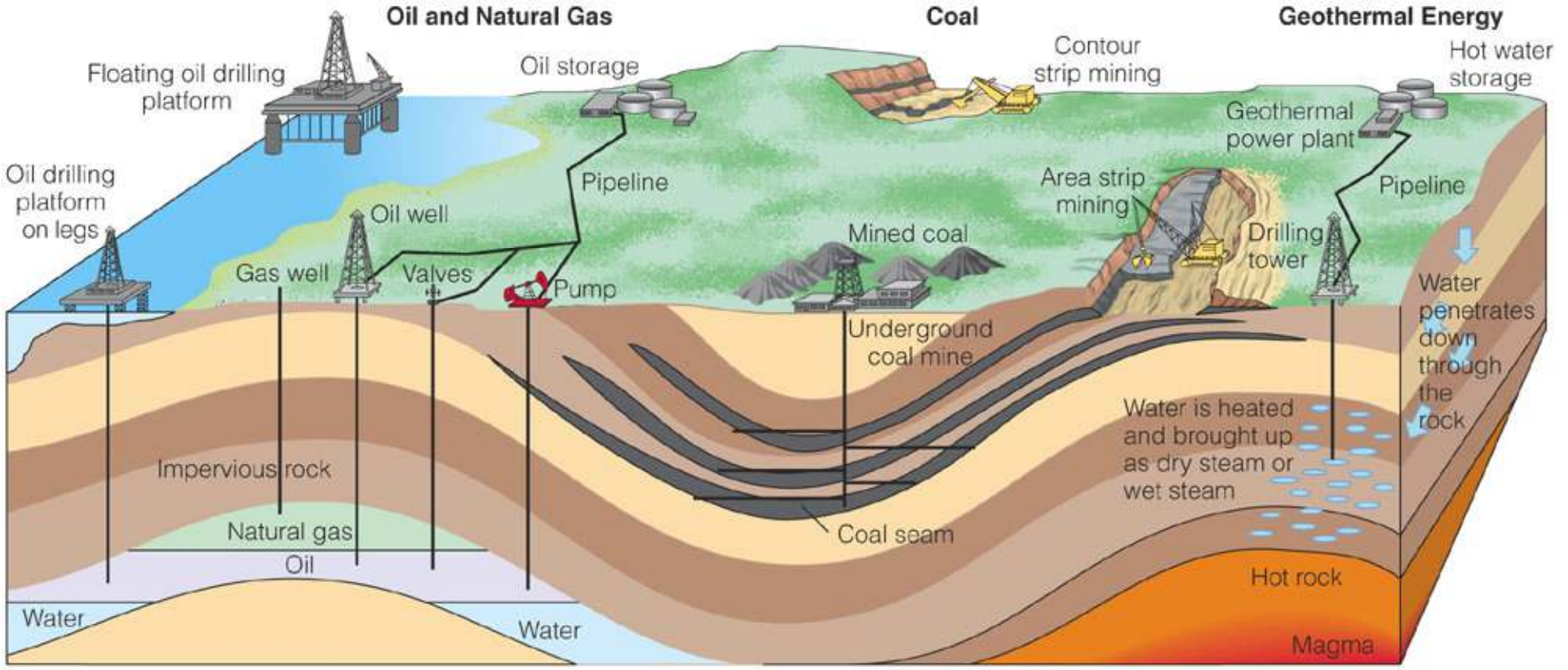
# What Is Electricity?

- **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.**



# Important Nonrenewable Energy Sources

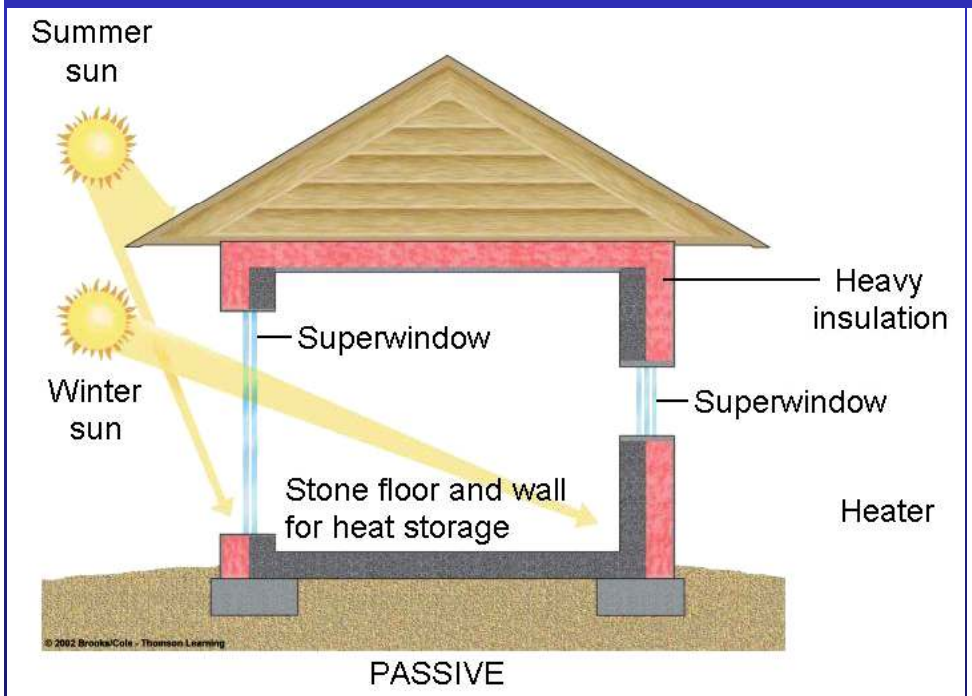


## *Production of Electricity by using following methods*

- Light
- Heat
- Friction
- Pressure
- Chemical Action
- Magnetism
- Motion

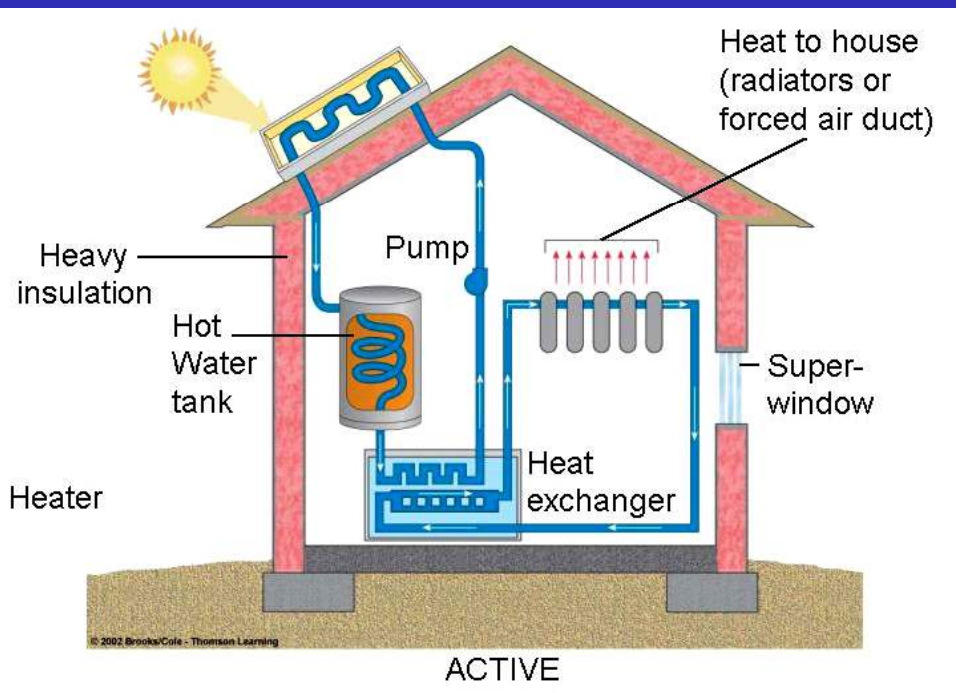
# *Using Solar Energy to Provide Heat*

## Passive solar heating




PASSIVE

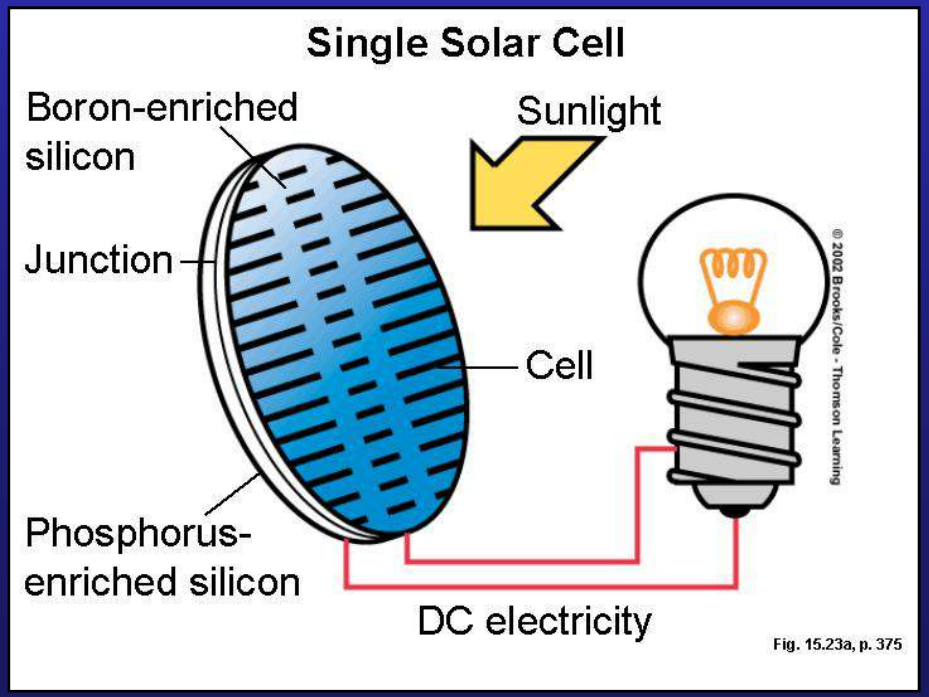
## Active solar heating




ACTIVE

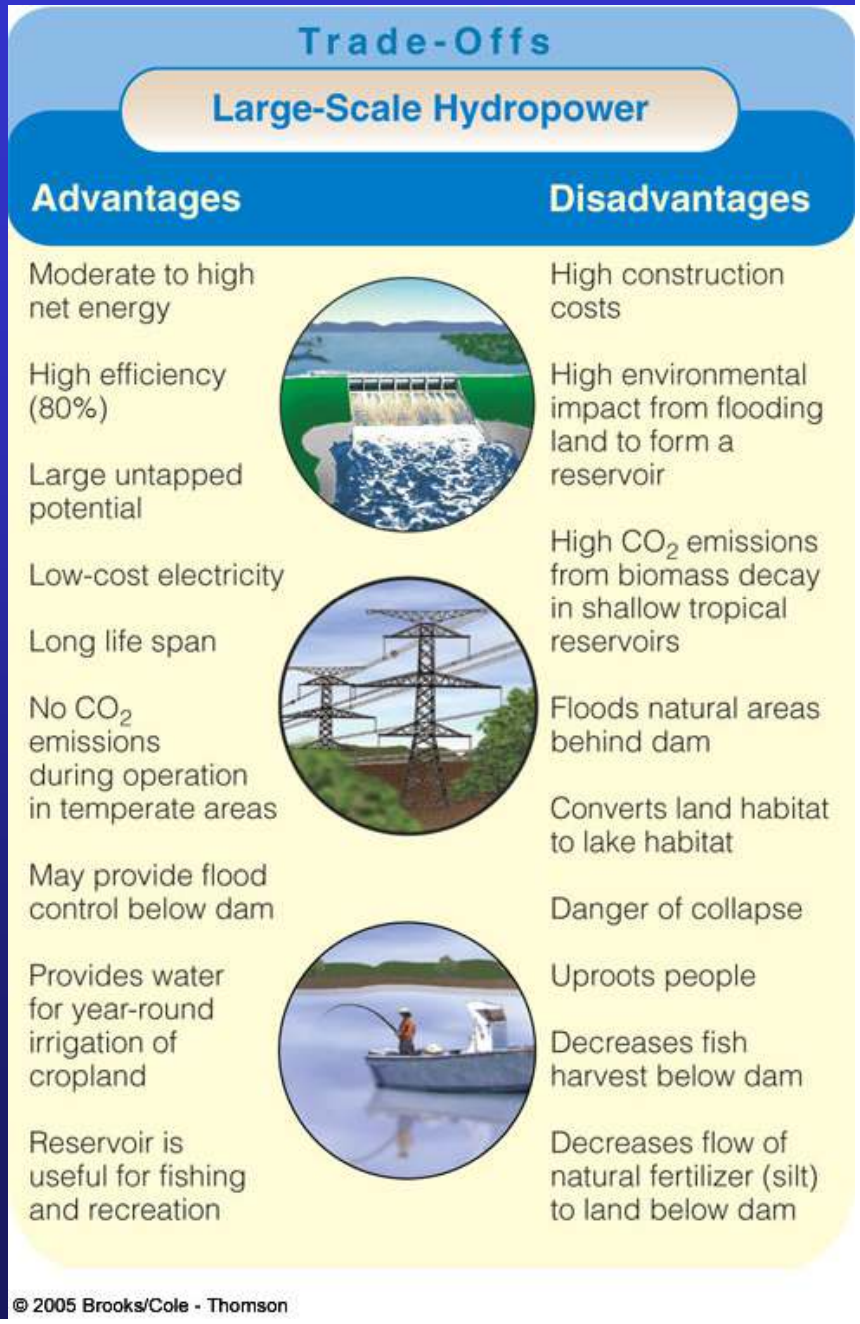
# *Using Solar Energy to Provide High-Temperature Heat and Electricity*

- Solar thermal systems
- Photovoltaic (PV) cells

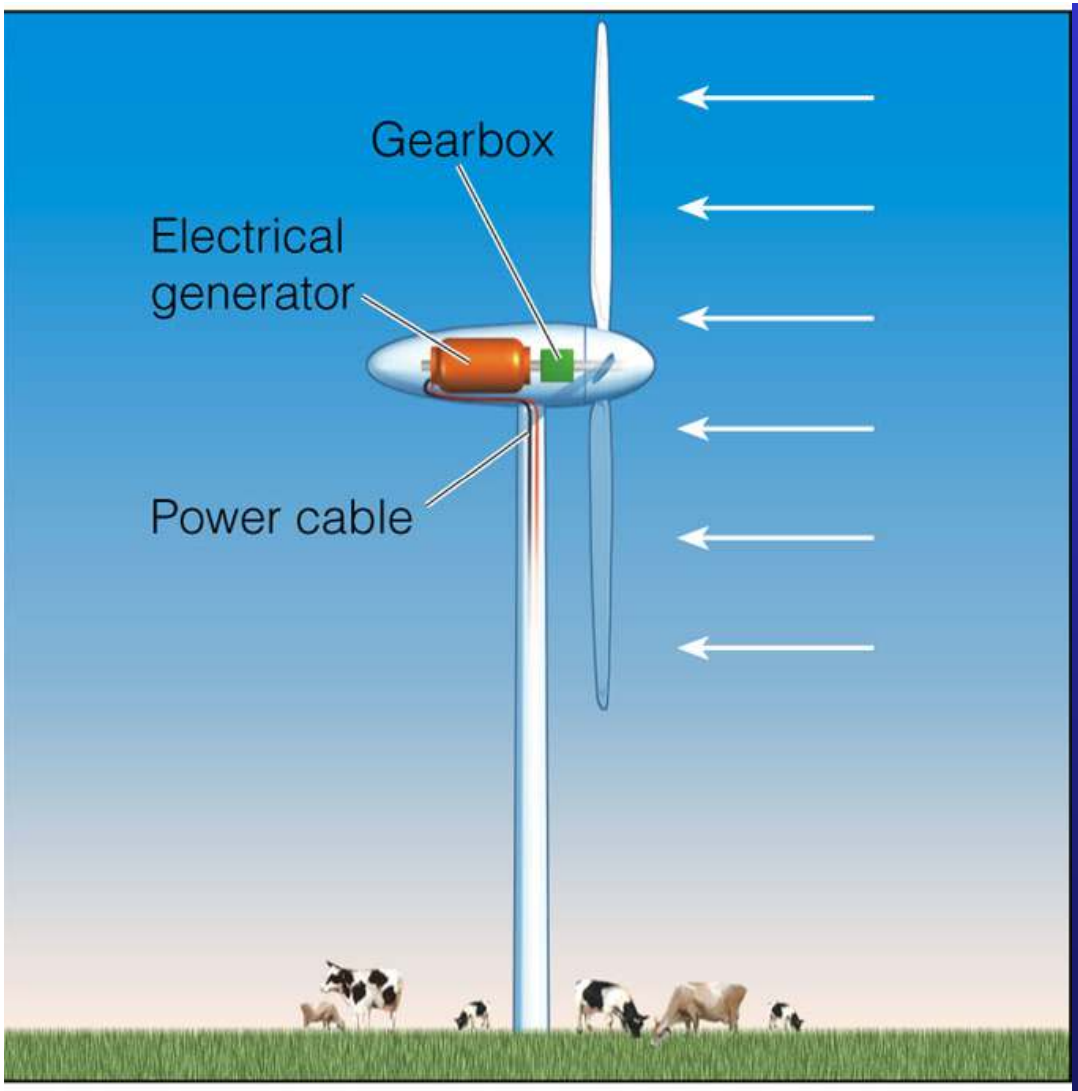



## *Producing Electricity from Moving Water*

- Large-scale hydropower
- Small-scale hydropower
- Tidal power plant
- Wave power plant



# Producing Electricity from Wind




**Wind turbine**



## Trade-Offs

### Wind Power

| Advantages | Disadvantages |
|---|---|
| Moderate to high net energy | Steady winds needed |
| High efficiency | Backup systems needed when winds are low |
| Moderate capital cost | High land use for wind farm |
| Low electricity cost (and falling) | Visual pollution |
| Very low environmental impact | Noise when located near populated areas |
| No $CO_2$ emissions | May interfere in flights of migratory birds and kill birds of prey |
| Quick construction | |
| Easily expanded | |
| Can be located at sea | |
| Land below turbines can be used to grow crops or graze livestock | |

# LIGHT

The term photo electricity is used for generating voltage by using light. When light strikes the surface of a substance, it may dislodge electrons from their orbits around the surface atoms of the substance. This occurs because light has energy, the same as any moving force. Some form of the photoelectric principle is used in television cameras, automatic manufacturing process controls, solar calculators, and intrusion detection alarms.

Energy produced by light being absorbed by photoelectric cells

# Solutions: A Sustainable Energy Strategy

**Improve Energy Efficiency**

Increase fuel-efficiency standards for vehicles, buildings, and appliances

Mandate government purchases of efficient vehicles and other devices

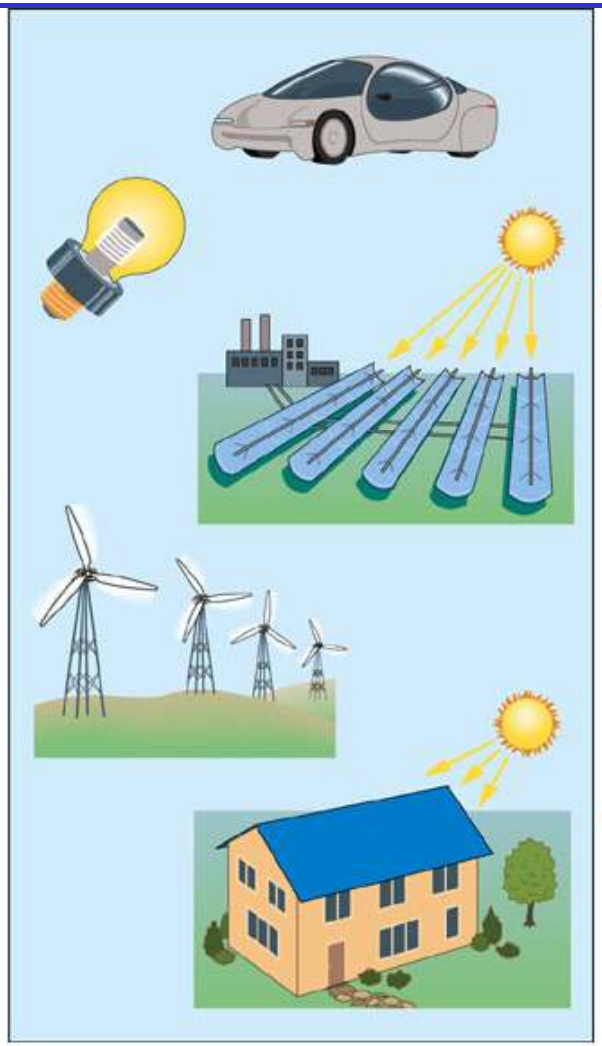
Provide large tax credits for buying efficient cars, houses, and appliances

Offer large tax credits for investments in energy efficiency

Reward utilities for reducing demand for electricity

Encourage independent power producers

Greatly increase energy efficiency research and development



**More Renewable Energy**

Increase renewable energy to 20% by 2020 and 50% by 2050

Provide large subsidies and tax credits for renewable energy

Use full-cost accounting and life cycle cost for comparing all energy alternatives

Encourage government purchase of renewable energy devices

Greatly increase renewable energy research and development

**Reduce Pollution and Health Risk**

Cut coal use 50% by 2020

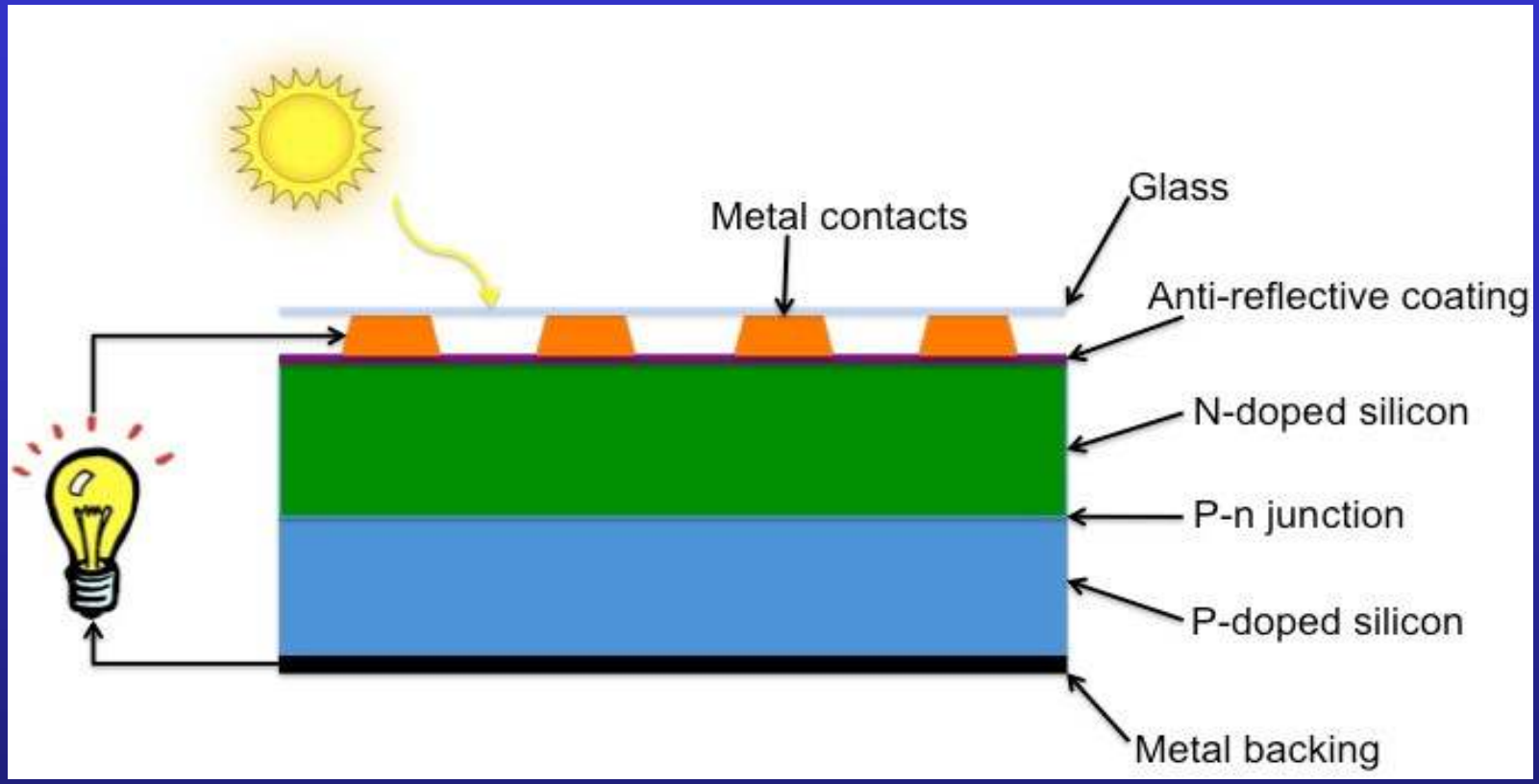
Phase out coal subsidies

Levy taxes on coal and oil use

Phase out nuclear power or put it on hold until 2020

Phase out nuclear power subsidies

# PV Cell Basic Function




How do solar panels work-.mp4

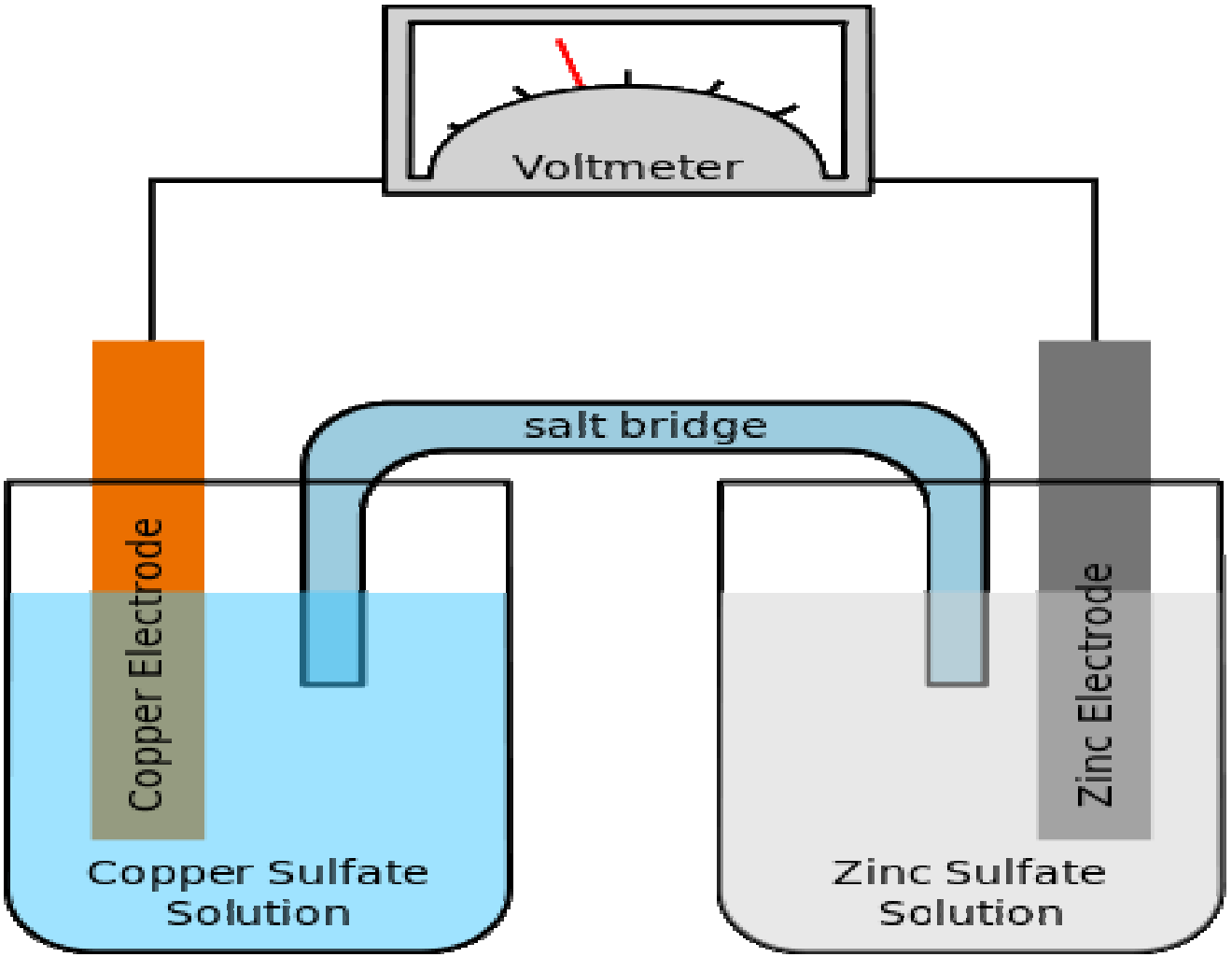
# How PV works —

- PV cells use the photoelectric effect. In the simplest form, they consist of thin wafers of a semiconductor (silicon) in a sandwich.
- One layer is doped with phosphorus (N for negative) and the other is doped with boron (P for positive).
- The term "doped" means that something was added to the silicon wafer. The N- and P-doped layers are separated by a tiny space called the P-N junction.
- When sunlight hits the PV cell, it drives electrons from the N-layer to the P-layer. B
- y connecting the two layers with a wire, a circuit is created as the electrons flow back to the P-layer.
- That flow of electrons can be then used to do work. When the light goes away, so does the electron flow.

# CHEMICAL ACTION

Voltage may be produced chemically when certain substances are exposed to chemical action. Another word for producing voltage by chemical action is **electrochemistry.** An ordinary battery, either wet or dry, produces voltage by chemical action.

Energy produced by chemical reaction in a voltaic cell.




# Galvanic Cell

# MAGNETISM

Current flows when you subject electrons to the force of a magnetic field. Magnetism is the most popular way to generate electricity today. Almost all electric power stations operate by producing magnetism-generated electricity.

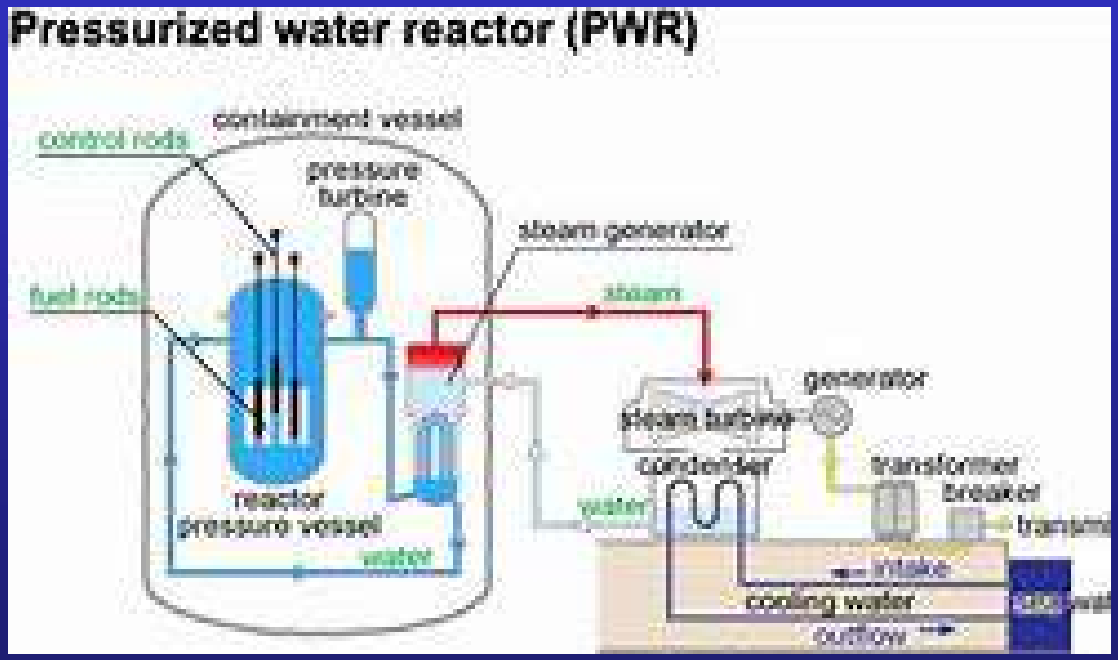
Energy produced in a conductor that cuts or is cut by magnetic lines of force

# FRICTION

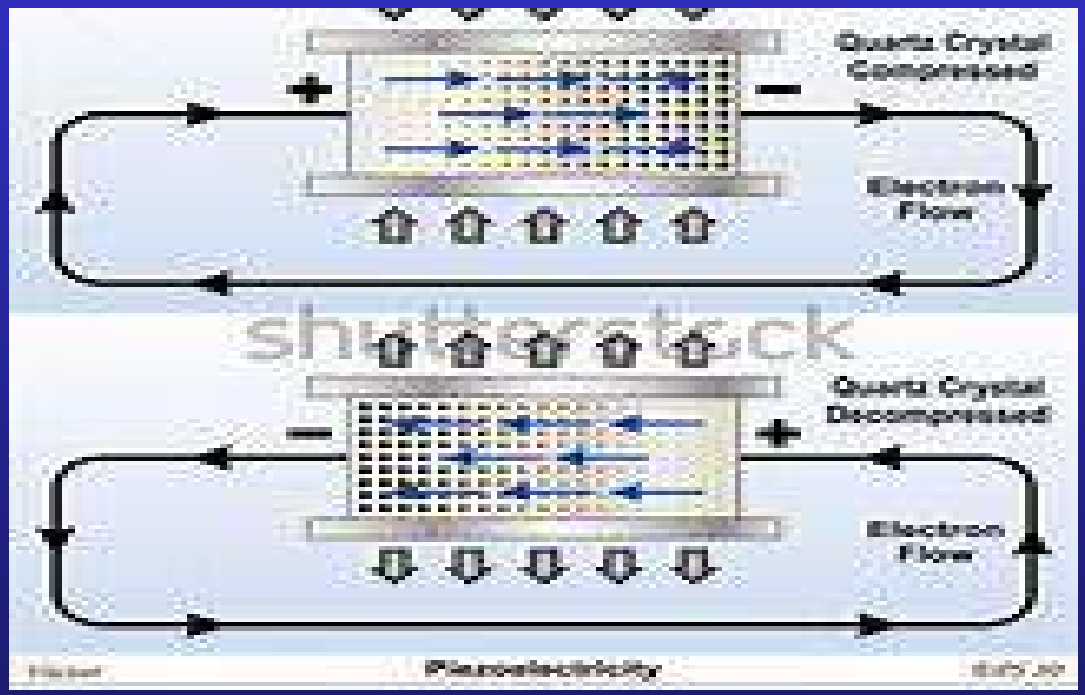
Rubbing two different materials together and creating static electricity; very impractical and used little. (Research is ongoing for emerging technology such as charging cell phones w/friction in clothing).

Energy produced by rubbing two material together.

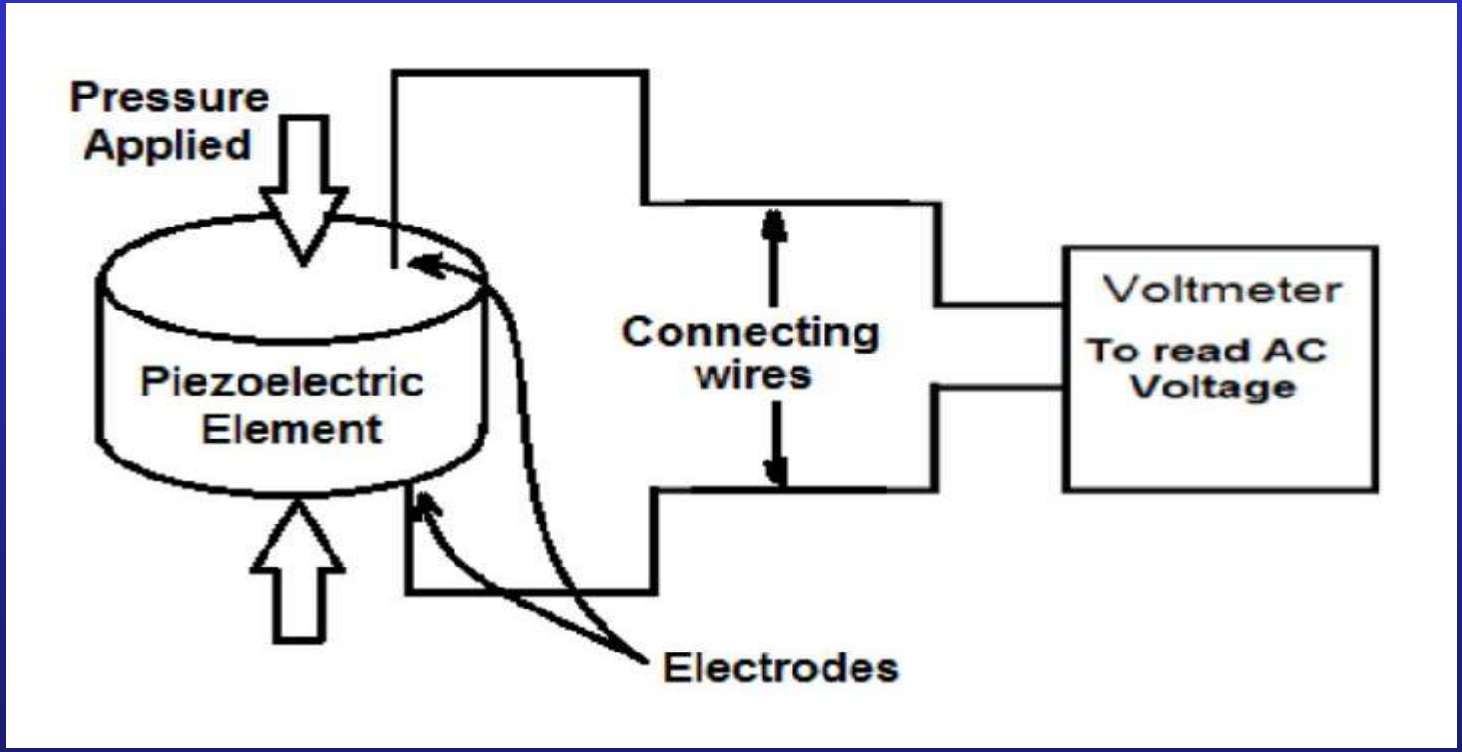
# *Electricity produced by pressure*



# *Electricity produced by pressure*



# *Electricity produced by pressure*



# PRESSURE

Also called piezoelectricity; Quartz or similar crystals can be used to convert mechanical energy into electrical energy. Used in low voltage applications such as microphones, radio receivers and sonar equipment

Energy produced by compressing or decompressing specific crystals.

# HEAT

- Heat generated voltages can be produced by heating the junction of two unlike materials such as iron and copper. Thermocouple is the term for the device that produces voltages using heat. They are widely used to measure temperature and as heat-sensing devices in automatic temperature control equipment.

Energy produced by heating the junction where two unlike metals are joined.

# ELECTRICITY PRODUCED BY FRICTION

# ELECTRICITY PRODUCED BY FRICTION

II. What is static electricity?

a. Electricity produced when electrons are rubbed off one object and collect on another (friction)

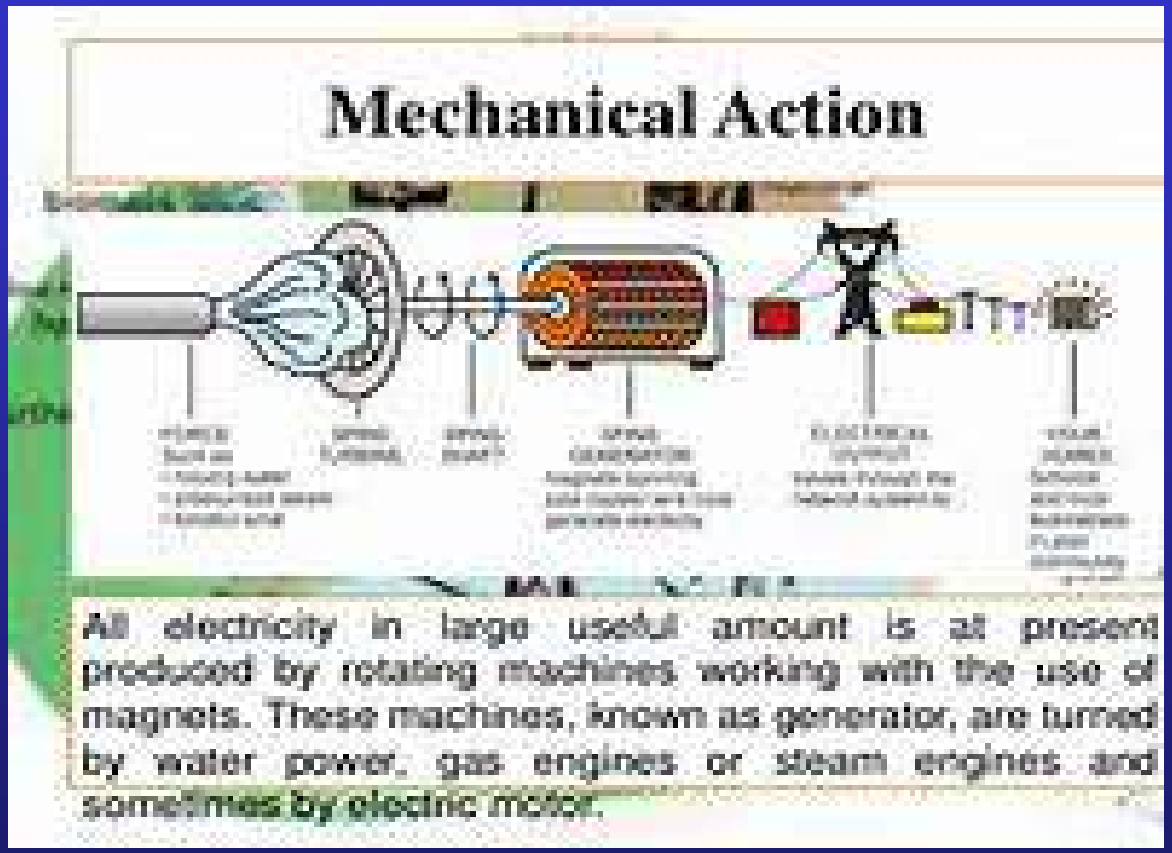
III. What are three examples of static electricity?

a. Rubbing feet on a carpet – electrical discharge

b. Hair rising with your sweater

c. Lightning

# ELECTRICITY PRODUCED BY MECHANICAL ACTION



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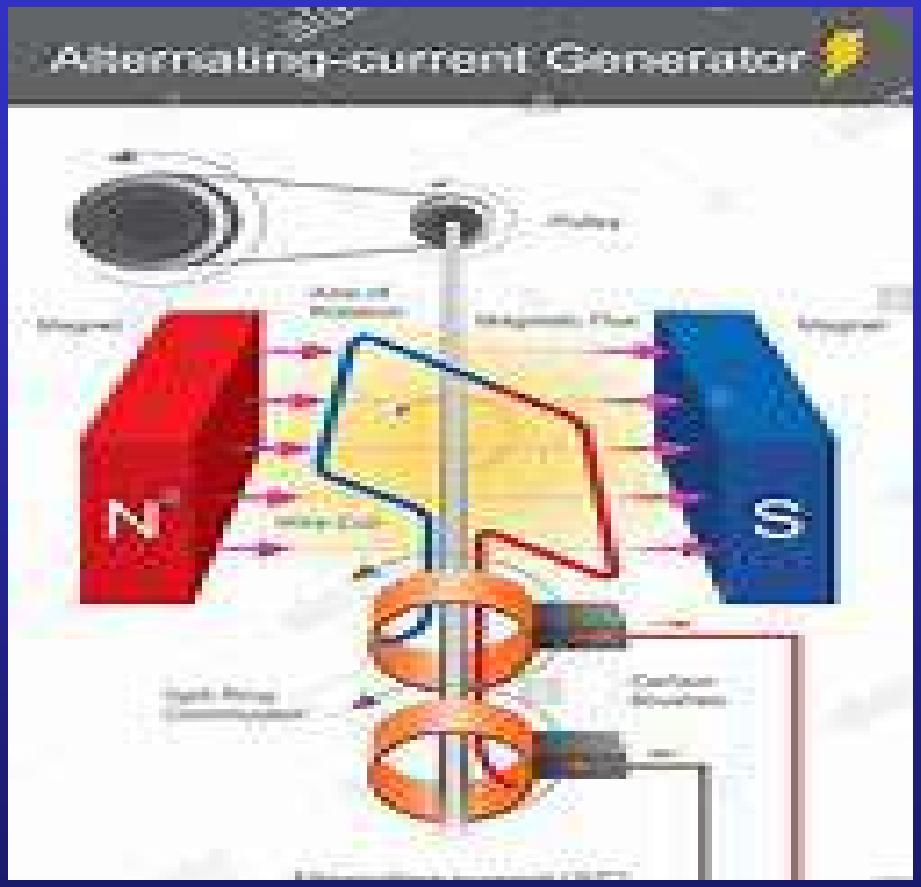

# ELECTRICITY PRODUCED BY MECHANICAL ACTION