

Energy Industry Fundamentals

## Module 3, Unit C

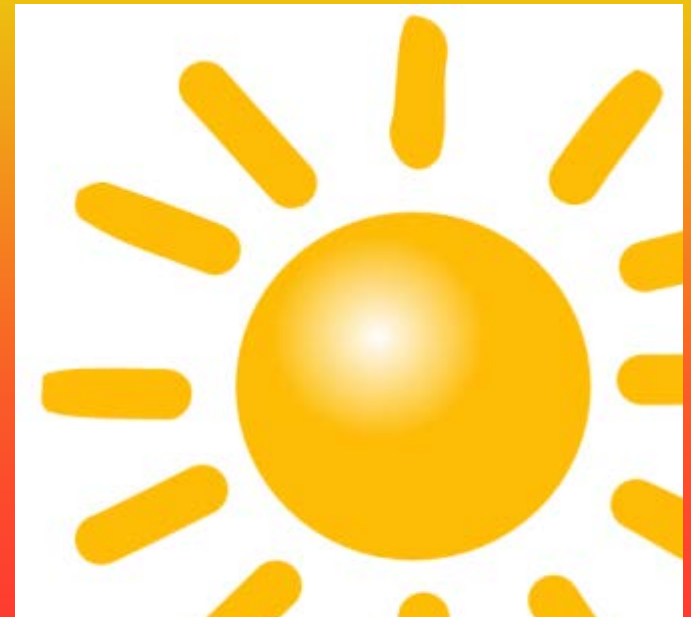
# Alternative Sources for Generating Electric Power

# Objectives

- Solar power generation
- Photovoltaic technology
- Wind power generation
- Turbine generation technology
- Geothermal power generation
- Types of geothermal power plants
- Biomass and biogas generation
- Ocean wave and tidal power generation and generation technology

# Solar

- Radiant energy from the sun
- Power from the sun is expected to last for billions of years
- Solar energy is used for:
  - Passive solar heating
  - Photovoltaic energy
  - Active solar heating
  - Solar steam systems



# Solar Photovoltaic Energy

Like a battery, solar photovoltaic energy relies on **chemical reactions** to generate electricity.

When sunlight hits a solar cell, **photons** (bundles of radiant energy) emit energy, which excites electrons and conducts electric current through the material of the solar cell.



# Solar Technology

Solar panels are connected to form **solar arrays**.

A large number of solar arrays is called a **solar farm**.

**Thermal solar power plants** use mirrors to focus and concentrate sunlight onto specific boilers or pipes.



# Wind

- **Inexhaustible** renewable resource
- The **capacity**, or electricity produced, depends on:
  - **Volume** and speed of the wind
  - **Size** of turbine and its individual blades





# Wind Technology

In wind turbines, the **mechanical energy** to rotate the generator comes from the force of the wind pushing against the blades of the turbine.

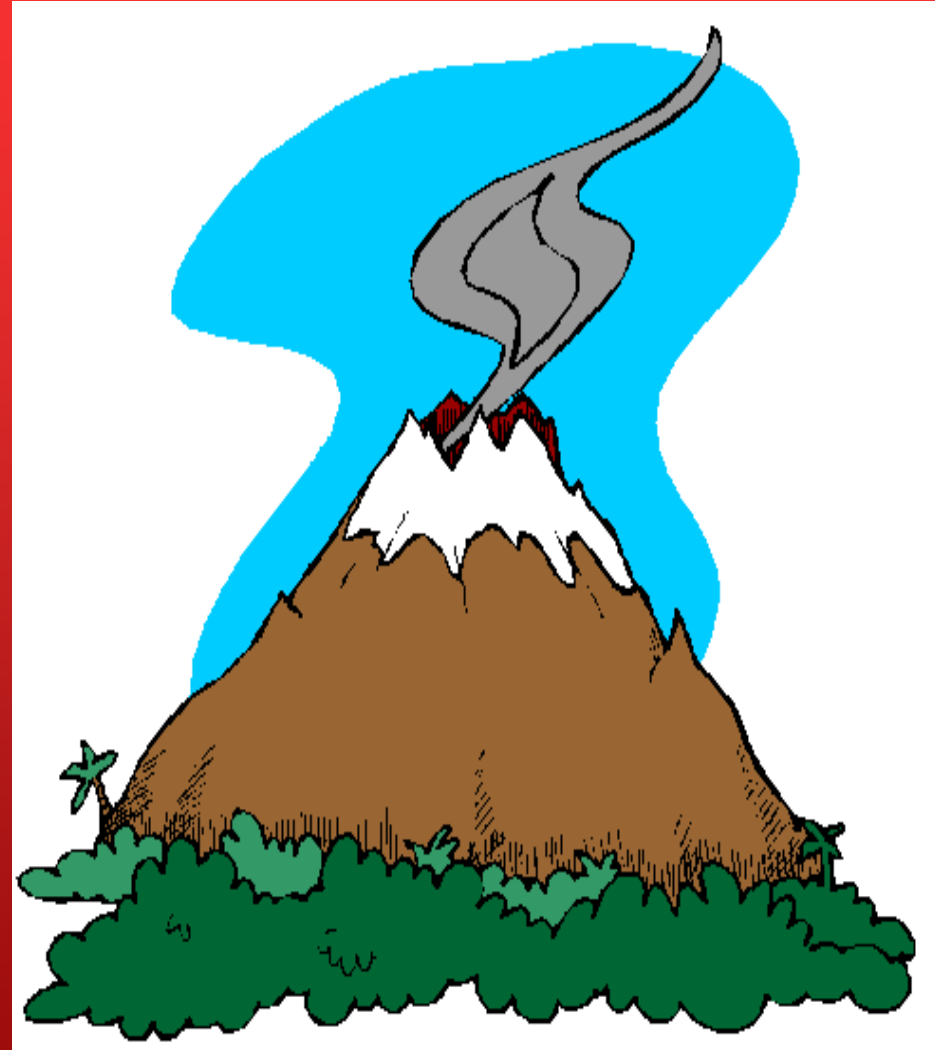
The rotation of the blades moves the magnetic field over the coils of the generator producing electrical current.



# Geothermal

Underground water reservoirs are naturally superheated which produces steam. We can harness this steam for electric generation purposes.

Geothermal energy is also relatively nonpolluting, clean, and safe





# Geothermal Technology

**Dry steam plants** use steam that comes directly from the heat source.

**Flash steam plants** use high-pressure hot water, which vaporizes into steam that turns a turbine to generate electricity.

**Binary cycle plants** use heat from lower temperature geothermal sources to vaporize a secondary fluid.



# Biomass

- Biomass energy can be transformed by:
  - Burning plant products and trash
  - Decay by **anaerobic digesters** into **biogas** (**methane**, with some CO<sub>2</sub> byproduct)
  - Fermentation
  - Biochemical conversion, which uses **enzymes** and **bacteria**



# Ocean Wave and Tidal

- Fixed devices include:
  - Oscillating Water Columns or TAPCHAN use waves flowing through or by the device
- Floating devices:
  - Harness the movement or bobbing of the floating device
- Tidal Barrage
  - Dam-type structure built across an estuary which takes advantage of the low and high tides



# Outcomes

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