



RENEWABLE ENERGY RESOURCES

INTRODUCTION TO ENERGY

- Energy is the capacity to do work.
- Electrical energy is essential for daily life, industries, transport, communication, and technology.
- Modern development depends heavily on electrical power.

NEED FOR ENERGY RESOURCES

- Energy demand increases due to population growth, industrialization, and urbanization.
- Conventional resources are limited.
- Hence alternative sustainable energy sources are required.

CLASSIFICATION OF ENERGY RESOURCES

- Energy resources are classified into:
 - Conventional energy resources
 - Renewable (non-conventional) energy resources

CONVENTIONAL ENERGY RESOURCES

- Includes coal, petroleum, natural gas, and nuclear fuels.
- They are exhaustible, polluting, and costly.
- These resources will be depleted over time.

RENEWABLE ENERGY RESOURCES

- Renewable energy comes from natural sources.
- They are replenished continuously.
- They are clean, safe, and sustainable.

MEANING OF RENEWABLE ENERGY

- Renewable energy is derived from natural processes.
- It does not get exhausted.
- It supports long-term energy security.

IMPORTANCE OF RENEWABLE ENERGY

- Reduces fossil fuel dependency.
- Minimizes pollution.
- Supports rural electrification.
- Ensures sustainable development.

ADVANTAGES OF RENEWABLE ENERGY

- Unlimited availability.
- Eco-friendly.
- Low operating cost.
- Reduces greenhouse gas emissions.

LIMITATIONS OF RENEWABLE ENERGY

- High initial cost.
- Weather dependent.
- Intermittent power generation.
- Needs energy storage.

SOLAR ENERGY

- Solar energy is obtained from the sun.
- The sun provides abundant radiant energy.
- It is the most widely available renewable source.

SOLAR RADIATION

- Solar radiation reaches Earth as electromagnetic waves.
- Depends on location, season, and weather.
- Measured in W/m^2 .

SOLAR ENERGY CONVERSION METHODS

- Solar thermal method.
- Solar photovoltaic method.
- Both convert sunlight into useful energy.

SOLAR THERMAL ENERGY

- Sunlight produces heat.
- Heat generates steam.
- Steam rotates turbine.
- Generator produces electricity.

PHOTOVOLTAIC PRINCIPLE

- Based on photovoltaic effect.
- Sunlight releases electrons.
- Electric current is produced directly.

SOLAR CELL

- Basic unit of PV system.
- Made of silicon.
- Produces DC output.
- Single cell voltage is about 0.5V.

SOLAR PANEL AND ARRAY

- Panels consist of many solar cells.
- Arrays combine panels.
- Used to increase voltage and current.

APPLICATIONS OF SOLAR ENERGY

- Street lighting.
- Solar pumps.
- Home systems.
- Satellites.
- Water heating.

WIND ENERGY

- Wind is moving air.
- Contains kinetic energy.
- Generated due to uneven heating of Earth.

PRINCIPLE OF WIND ENERGY

- Wind strikes turbine blades.
- Blades rotate.
- Mechanical energy converts to electrical energy.

WIND TURBINE

- Main parts include blades, shaft, gearbox, generator, and tower.

TYPES OF WIND TURBINES

- Horizontal axis wind turbines.
- Vertical axis wind turbines.

WIND POWER GENERATION

- Wind rotates turbine.
- Generator produces electricity.
- Power depends on wind speed.

ADVANTAGES OF WIND ENERGY

- Renewable.
- No fuel cost.
- Low pollution.
- Low operating cost.

LIMITATIONS OF WIND ENERGY

- Wind not available continuously.
- Noise.
- Large land requirement.

HYDROELECTRIC ENERGY

- Energy obtained from flowing water.
- Uses gravitational energy.
- One of the oldest renewable sources.

HYDRO POWER PLANT PRINCIPLE

- Water stored in dam.
- Flows through penstock.
- Rotates turbine.
- Generator produces electricity.

COMPONENTS OF HYDRO PLANT

- Dam.
- Reservoir.
- Penstock.
- Turbine.
- Generator.
- Tailrace.

TYPES OF HYDRO PLANTS

- Large hydro.
- Small hydro.
- Micro hydro.

ADVANTAGES OF HYDRO POWER

- High efficiency.
- Long life.
- Low running cost.
- Reliable power.

DISADVANTAGES OF HYDRO POWER

- High initial cost.
- Environmental impact.
- Depends on rainfall.

BIOMASS ENERGY

- Derived from organic matter.
- Includes wood, crop waste, animal dung.
- Stores solar energy.

BIOMASS CONVERSION METHODS

- Direct combustion.
- Gasification.
- Biogas production.

BIOGAS PLANT

- Uses organic waste.
- Produces methane gas.
- Used for cooking and electricity.

GEO THERMAL ENERGY

- Energy from Earth's interior.
- Uses underground heat.
- Location specific.

TIDAL ENERGY

- Energy from sea tides.
- Caused by gravitational pull of moon.
- Predictable renewable source.

COMPARISON OF RENEWABLE SOURCES

- Solar – abundant.
- Wind – location dependent.
- Hydro – reliable.
- Biomass – easily available.

ROLE OF RENEWABLE ENERGY

- Supports sustainable power systems.
- Important for future electrical engineers.

CONCLUSION

- Renewable energy is the future.
- Clean and sustainable.
- Essential for long-term power generation.

THANK YOU

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