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Role of Renewable Energy in Agriculture

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Energy is the basic need of human beings. Humans revealed a new path in science by using conventional energy sources and non-conventional energy sources. But most of the innovation depends upon conventional energy sources get affect on environment and human health in running days. We are interested in turning science into green science by using non-conventional sources. Renewable energy systems are rapidly becoming more efficient and cheaper and their share of total energy consumption is increasing. Global installed electricity generating capacity in 2021 was 2.8 TW. Growth in consumption of coal and oil could end by 2025 due to increased uptake of renewables and natural gas. Rapid deployment of renewable energy and energy efficiency is resulting in significant energy security, climate change mitigation and economic benefits. Renewable energy contributes 29 per cent to human's global energy consumption and 38 per cent to the generation of electricity. In view of farmers, there is 4-5 hours of power supply which is not sufficient for them to irrigate the entire field. So, government of India introduced the PM-KUSUM scheme where a subsidy is provided to install a solar-powered irrigation system in farmer fields. By adopting renewable energy, we save cost, labour, time, etc. Biofuel is also one of the important sources of energy that help reduce import dependency on crude oil. They can contribute to a cleaner environment, generate additional income for farmers and create rural jobs.

Renewable energies

- ✓ Hydropower energy
- ✓ Solar energy
- ✓ Wind energy
- ✓ Biofuel energy
- ✓ Biogas energy

India is one of the largest producer of energy from the renewable sources. In the electricity sector, renewable energy (including large hydro) accounted for 29 per cent of the total power capacity installed. The large hydro installed capacity was 45.29 GW, contributing to 14% of the total power capacity. India has a wind potential of more than 300 GW at a hub height of 100 meters, a solar potential of 750 GW assuming 3% wasteland is made available and a small hydro potential of 20 GW. The bioenergy potential has been estimated at 25 GW. Renewable energy has a great capacity to usher in universal energy access. In a decentralized or standalone way, renewable energy is a quite appropriate, scalable and viable solution for providing power.

Irrigated agriculture contributes to 60 per cent of food production. The cropping intensity is more due to more resource availability. Land value, farmers' income, and standard of living is high. Inputs and labour requirements is more in the case of irrigated agriculture where the major energy is utilized for spraying and pumping water to the field.

Present status of renewable energy sources: India

- ➢ 3rd largest producer

- Wind power - 40,083 MW and placed at 4th position after China, USA and Germany
- Three world's largest solar park out of five
- **Bhadla Solar Park (RJ) – 2245MW**
- **Pavagada solar park (KA)** – 2050MW
- **2,37,120 Solar Pumps** for irrigation and drinking water purposes
- **1,836 MW -** installed capacity of biomass power plants
- **7,562 MW -** installed capacity of Bagasse cogeneration
- **982.30 MW -** solar rooftop power projects

In Karnataka, 15,040 MW of electricity is generated from renewable sources. Solar energy alone contributes 7,172 MW followed by wind energy of 5,095 MW, Biopower/ cogeneration units of sugar factories can generate about 1870 MW, and Small hydro power generating units contribute 903 MW. By this, we can know that solar energy is gaining more popularity.

Problems due to Non-renewable energy resources

- Energy crisis in future
- Environmental pollution
- Greenhouse gas emission
- Degradation of forest and soil
- Oil spills and other accidents
- Acid rain and water pollution

Advantages of renewable energy

- They are renewable recur in nature and are in-exhaustible.
- Renewable energy is more site specific.
- There is no need for transmission and distribution of power.
- Renewables have low energy density and more or less there is no pollution.
- Most of the devices and plants used with renewables are simple in design and construction and are made from local materials, local skills and local people.
- Environmentally clean source and pollution-free.
- The use of renewable energy can help to save foreign exchange and generate local employment.
- The rural areas and remote villages can be better served with locally available renewable sources of energy.

Hydro energy

India is the 7th largest producer of hydroelectric power in the world. Hydropower is a clean, domestic, and renewable source of energy. It provides inexpensive electricity and produces no pollution unlike fossil fuels, hydropower does not destroy water during the production of electricity.

Principle involved in hydropower: The principle of hydropower is that the potential energy of the water stored at great heights in the dam is converted into kinetic energy by allowing the water to flow at high speed. Then the kinetic energy of flowing water is used to generate electricity. In hydroelectric power stations, the flowing water is stopped in high-altitude rivers by constructing dams. The water stored possessed a very large amount of potential energy. Then the water is allowed to fall through pipes on the blades of big water called turbines. These turbines are connected to electric generators.

Application of hydro-electricity in agriculture

- To lift water
- Drying of products
- Dairy and poultry
- Green house heating and cooling
- Processing of food products
- Cold storage

Solar energy

Solar Photovoltaic cell principle: The fundamental component of the system that uses the photovoltaic effect to generate electricity from light energy is the photovoltaic cell. When constructing solar cells, silicon is the semiconductor material that is most frequently employed. A considerable number of free electrons are created in semiconductor materials when they are exposed to light as a part of the photons of light rays are absorbed by the semiconductor crystal. On March 1, 2018, Karnataka opened the largest solar park in the world, located at Pavagada, with a capacity of 2045 MW is currently the third-largest solar park in the world.

Application of solar energy in crop production

- ✓ Soil solarization
- ✓ Solar sowing machine
- ✓ Solar fencing
- ✓ Solar drying
- ✓ Solar sprayer
- ✓ Solar insect taps
- ✓ Solar pumps for irrigation

Soil solarization

- Soil solarization is a sustainable technique that harnesses solar energy to manage soil-borne plant pathogens, fungi, bacteria, nematodes, insect, and mite pests, as well as weed seed and seedlings. The process involves mulching the soil and encasing it in a transparent polyethene cover to capture solar energy.
- Moreover, it might describe methods of decontaminating soil with sunlight or solar power.
- In general, 4 to 6 weeks of soil heating during the warmest time of the year would be sufficient to control most soil pests.

Recent technologies in solar

- ✓ Solar PV duster
- ✓ Solar PV winnower
- ✓ Solar cold storage
- ✓ Solar operated Tractors and weeding machines
- ✓ Solar sensor-based weeder
- ✓ Solar drones

The advantages of solar energy

- ❖ It is a renewable source of energy
- ❖ Environmentally clean source of energy and
- ❖ Freely available in adequate quantities in almost all parts of the world where people live.

The main problems associated with solar energy

- ❖ Dilute source of energy and
- ❖ Availability varies widely with time.
- ❖ Dust problem.

Wind energy

Wind is the world's fastest growing energy source today. India is the fourth largest wind power producer in the world, after China, USA and Germany. Wind turbines create power without using fossil fuels and without producing greenhouse gases or radioactive or toxic waste. Wind turbines convert the kinetic energy in the wind into mechanical power. A generator convert mechanical power into electricity. General applications of wind mills are water pumping, fodder cutting, grain grinding, power generation etc.

- ➢ The largest wind farm of India is located in Muppandal, Tamil Nadu.
- ➢ Wind farm in Jaisalmer, Rajasthan

Advantages of wind energy

- ❖ It is a renewable source of energy.

- ❖ It is non-polluting and no adverse effect on the environment.
- ❖ No fuel and transportation is required.

Disadvantages of wind energy

- ✓ The available wind energy is dilute and fluctuating in nature.
- ✓ Unlike water energy, due to its irregularity wind energy requires storage capacity.
- ✓ Wind energy operating machines are noisy in operation.
- ✓ Wind power systems have a relatively high overall weight.
- ✓ Large areas are required for wind mill.

Biofuels

- ✓ Biodiesel is the world's fastest growing alternative fuel.
- ✓ Biofuels, such as ethanol and biodiesel, are fuels for transportation that are derived from biomass.
- ✓ These fuels can be used alone, although they are typically mixed with petroleum fuels, specifically gasoline and diesel.
- ✓ Biodiesel and ethanol are also cleaner burning fuels, producing fewer air pollutants.
- ✓ Ethanol is an alcohol fuel made from the sugars found in grains such as corn, sorghum, wheat, rice, sugarcane and sugar beets by fermentation.

Utilization of by-products in crop production

- Cakes used as a concentrated manure to supply nutrients.
- Bio char used as soil amendment.
- Waste residues used for preparation of compost.
- Biogas slurry used as nutrient source and soil conditioner.

Disadvantages of renewable energy

- ➢ Initial investment
- ➢ Time bounded
- ➢ Theft and damages
- ➢ Dust problem in SPV
- ➢ Require more space
- ➢ Require storage units

Conclusion

- ➢ Renewable energy sources are boon to agriculture in providing inexpensive, eco-friendly electricity in remote locations to take up timely farm operations.
- ➢ Solar and hydro energies are cheaper than the existing power source in application to the electric fence, lighting bulb and lifting water for irrigation purposes.
- ➢ Renewable energy minimizes the drudgery of work and is more effective than manual spraying.