AGRIPV IN INDIA -ECONOMY

The Union Budget 2026–27 increased the PM-KUSUM allocation to ₹5,000 crore, signalling renewed focus on solarising agriculture along with plans to include AgriPV under PM-KUSUM 2.0.

1.Introduction

1. Agri-Photovoltaics represents an innovative approach that integrates solar energy generation with agricultural production on the same land.
2. It addresses the growing challenge of land-use conflict between energy expansion and food security.
3. In the context of India's renewable energy targets and agrarian economy, AgriPV offers a pathway for sustainable and inclusive development.

2.Concept of Agri-Photovoltaics

Definition and Core Idea

1. AgriPV is a dual-use system where solar panels are installed in agricultural fields, enabling simultaneous electricity generation and crop cultivation.
2. Panels are placed at suitable heights or spacing to allow sunlight penetration and agricultural activities below or between them.
3. The objective is to maximise land-use efficiency without compromising agricultural productivity.

Strategic Objectives

1. To enhance farmer incomes through diversification of revenue sources.
2. To promote clean energy generation and support India's renewable energy transition.
3. To ensure sustainable land use by balancing food production and energy needs.

3.AgriPV Pilot Projects in India

Uttar Pradesh Experience

1. A pilot project at Amity University, Noida demonstrated the feasibility of AgriPV systems.
2. Crops such as maize, potato, and mustard were successfully cultivated alongside solar panels.
3. The project highlighted the compatibility of certain crops with partial shading.

Maharashtra Initiatives

1. The state has identified thousands of substations for solarisation through AgriPV systems.
2. This initiative has the potential to add significant solar capacity while utilising agricultural land efficiently.
3. It reflects a move towards decentralised and farmer-centric energy solutions.

4.Crop Selection in AgriPV Systems

Importance of Crop Selection

1. Crop performance depends on sunlight availability under solar panels.
2. Proper selection ensures optimal yield despite partial shading conditions.

Suitable Crop Categories

1. Shade-tolerant crops such as turmeric, ginger, and leafy vegetables perform well under panels.
2. Sunlight-intensive crops are cultivated in spaces between panel rows.

Regional Variations

1. In regions like Madhya Pradesh, crops such as tomato, onion, garlic, and tulsi are suitable.
2. In Karnataka and Maharashtra, crops like ragi, jowar, grapes, and brinjal are compatible with AgriPV systems.
3. This highlights the need for location-specific crop planning.

5.Types of AgriPV Systems

Elevated Systems

1. Solar panels are mounted at a height, allowing farming activities beneath them.
2. This is one of the most common and effective configurations.

Row-Based Systems

1. Panels are installed between crop rows to minimise shading.
2. This system balances energy generation with crop growth.

Vertical Systems

1. Panels are placed vertically, often bifacial, capturing sunlight from both sides.
2. They reduce shading and allow more uniform crop exposure.

Greenhouse-Integrated Systems

1. Solar panels are integrated with greenhouse structures.
2. This enables controlled-environment agriculture along with energy production.

6.Benefits of Agri-Photovoltaics

Land Use Optimization

1. AgriPV enables dual use of land, reducing competition between agriculture and solar energy projects.
2. It is particularly important in land-scarce and densely populated regions like India.

Economic Benefits for Farmers

1. Farmers can generate additional income through electricity generation, leasing, or revenue sharing.
2. It reduces income dependency on crop yields alone.

Environmental Advantages

1. Partial shading reduces evapotranspiration, improving soil moisture retention.
2. It enhances water-use efficiency and supports climate-resilient agriculture.

Climate Protection for Crops

1. Solar panels act as protective shields against extreme weather such as heatwaves, heavy rainfall, and hailstorms.
2. This reduces crop damage and improves yield stability.

Rural Development and Energy Access

1. AgriPV can support rural infrastructure such as cold storage and food processing units.
2. It promotes energy access and strengthens rural value chains.

7.Challenges in AgriPV Adoption

Policy and Regulatory Gaps

1. Lack of clear policy frameworks and design standards limits large-scale adoption.
2. Issues related to land classification, tariffs, and grid connectivity create uncertainty.

High Capital Costs

1. AgriPV systems are significantly more expensive than conventional solar installations.
2. Elevated structures and advanced designs increase initial investment requirements.

Limited Awareness and Technical Knowledge

1. Farmers often lack awareness and technical expertise to adopt AgriPV systems.
2. This slows down adoption, especially in rural areas.

Lack of Empirical Data

1. There is limited large-scale evidence on optimal configurations and crop combinations.
2. This creates hesitation among policymakers and investors.

8.Way Forward

Strengthening Policy Support

1. Dedicated policies and incentives are needed to scale up AgriPV adoption.
2. Integration with schemes like PM-KUSUM can enhance feasibility.

Financial and Institutional Support

1. Viability gap funding and concessional financing can reduce capital barriers.
2. Public-private partnerships can accelerate investment.

Capacity Building and Awareness

1. Training programmes for farmers and stakeholders are essential.

2. Demonstration projects can showcase benefits and build confidence.

Standardisation and Research

1. Development of standard designs and guidelines can reduce uncertainty.
2. Research across agro-climatic zones can identify optimal models.

9. Conclusion

Agri-Photovoltaics offers a transformative solution to reconcile the dual challenges of energy security and agricultural sustainability. By enabling efficient land use and diversified incomes, it supports both environmental and economic goals. With appropriate policy support, technological innovation, and capacity building, AgriPV can become a key pillar of India's sustainable development strategy.

Source: https://www.thehindu.com/sci-tech/energy-and-environment/how-agripv-can-turn-indias-farms-into-dual-purpose-powerhouses/article70772076.ece