

NEXT IAS

**DAILY EDITORIAL
ANALYSIS**

TOPIC

**AGRI-PHOTOVOLTAICS (AGRIPV)
AND PM-KUSUM: A DUAL-PURPOSE
POWERHOUSES**

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Context

- The **Union Budget 2026–27** nearly **doubled the allocation** for the **PM-KUSUM scheme** to 5,000 crore, signalling a renewed push toward solarisation of agriculture.
 - ♦ However, expanding **solar infrastructure without compromising food security** remains a critical policy challenge.

What is Agri-Photovoltaics (AgriPV)?

- **Agri-photovoltaics (AgriPV)** refers to the integration of **solar photovoltaic systems with agricultural practices** on the same land parcel.
- It can improve **overall land productivity (Land Equivalent Ratio >1)**, making it more efficient than separate land uses.
- It emerges as a viable solution by enabling **dual land use i.e. simultaneous crop cultivation and solar power generation**.

Types of AgriPV Systems

- **Elevated Systems:** Panels mounted several metres high to allow farming below
- **Row-based Systems:** Panels placed between crop rows
- **Vertical Systems:** Upright bifacial panels capturing sunlight from both sides
- **Greenhouse-integrated Systems:** Solar panels integrated into protected cultivation structures

Crop Selection: Key Determinant

- Crop productivity under AgriPV depends largely on **shade tolerance**:
 - ♦ **Shade-tolerant crops** perform well under panels;
 - ♦ **Sunlight-intensive crops** grow better between panel rows;
- **Moderate shading (~20–30%) can maintain or even enhance yields** by reducing heat stress.

Economic and Business Models

- AgriPV scalability depends on viable financial arrangements:
 - ♦ **Farmer-owned Models:** Use electricity and sell surplus;
 - ♦ **Cooperative/FPO-based Models:** Aggregation improves bargaining power;
 - ♦ **Developer-led Models:** Land leasing or revenue-sharing;
 - ♦ **Public sector Models:** State-led decentralised energy systems;
- AgriPV can **increase farm income by over 30%** when energy and agriculture are combined.

Why AgriPV Matters for India?

- **Addressing Land Scarcity:** India targets **300 GW solar capacity by 2030**; large-scale solar requires vast land; and over **50% of land is agricultural**;
 - ♦ AgriPV reduces **land-use conflict** by enabling dual utilisation.
- **Enhancing Farmer Income:** Income from **electricity sales, leasing, or shared revenues**; and diversification reduces agricultural risk.
- **Environmental Benefits:** Reduced **evapotranspiration and improved soil moisture**; protection from **heat, hail, and extreme weather**; and reduced dependence on **diesel pumps**.
 - ♦ AgriPV supports the **Water–Energy–Food nexus**, improving sustainability.

- **Rural Development:** Enables **cold storage, food processing, and agro-industries**; and promotes **rural entrepreneurship and decentralised energy systems**.

Challenges in Scaling AgriPV

- **Economic Barriers:** High capital cost due to **elevated structures and specialised mounting systems**; and cost higher than conventional solar.
- **Agricultural Uncertainty:** Crop yields vary depending on **design and shading patterns**; and poor design may reduce productivity.
- **Regulatory Issues:** Land classification and ownership ambiguity, and lack of clarity on **tariffs, grid connectivity, and revenue sharing**.
- **Institutional Constraints:** Limited technical standards and design benchmarks; investor uncertainty due to lack of policy clarity.

Policy Pathways for India

- **Integration with PM-KUSUM 2.0:** Proposed **National Agri-Photovoltaics Mission (10 GW)**; and **Viability Gap Funding (VGF)** to reduce capital burden.
- **Clear Policy Framework:** Recognise **dual-use land systems**, and standardise **designs and tariffs**.
- **State-Level Interventions:** Identify **AgriPV clusters**, streamline approvals and provide **farmer training**.
- **Strengthening Institutions:** Promote **FPO participation**, and improve access to **credit and finance**.

Conclusion

- Agri-photovoltaics represents a **transformative solution at the intersection of agriculture, energy, and sustainability**. It addresses India's twin challenges of **energy transition and food security**, by enabling dual land use.
- AgriPV can evolve from pilot projects to a **scalable national model**, enhancing farmer incomes while advancing climate goals, with appropriate policy support under PM-KUSUM 2.0.

Source: TH

Daily Mains Practice Question

- [Q] Examine how Agri-Photovoltaics (AgriPV) can serve as a dual-purpose model for enhancing farmer income and ensuring energy security, while addressing concerns related to food security, economic viability, and regulatory challenges.

