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EDITORIAL ANALYSIS

AgriPV — Resolving India's Energy-Food Land Use Conflict

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SUBJECTS COVERED

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AgriPV — Resolving India's Energy-Food Land Use Conflict

The Indian Express 23 March 2026 GS3

IE The Indian Express | MAINS RELEVANCE: GS Paper 3

INTERVIEW ANGLE

"India needs 300 GW of solar by 2030 but cannot afford to lose agricultural land. How does AgriPV technology address this trade-off, and what policy support does it need?"

WHY IN NEWS

The Indian Express published an analysis on Agri-photovoltaics (AgriPV), a dual-use technology that integrates solar power generation with farming on the same land. The 2026-27 Union Budget nearly doubled the PM-KUSUM scheme outlay to Rs 5,000 crore, and the government is considering a National Agri-photovoltaics Mission targeting 10 GW capacity.

What Is AgriPV?

Agri-photovoltaics (AgriPV) involves installing solar panels elevated above agricultural land, allowing crops to grow underneath while generating electricity from the panels above. This transforms **competing land use** (food vs energy) into **complementary land synergy**.

How It Works

FEATURE	DETAIL
Panel height	3-5 metres above ground (allows farm machinery access)
Panel spacing	Optimised for partial shade — benefits shade-tolerant crops
Dual output	Electricity from panels + crop yield from land below
Suitable crops	Leafy greens, tomatoes, peppers, herbs, pulses, some cereals
Water savings	15-30% reduced evaporation due to partial shading

Why India Needs AgriPV

India faces a fundamental land-use conflict:

CHALLENGE	DATA
Solar capacity target (2030)	300 GW
Land needed for ground-mounted solar	~1.5-2 million hectares (at 5 acres/MW)
Arable land share	~52% of total area (under pressure)
Farm holdings	~86% are small/marginal (<2 hectares)
Agricultural employment	~42% of workforce

Dedicating millions of hectares exclusively to solar panels would displace farming communities and threaten food security. AgriPV resolves this by enabling both on the same land.

The PM-KUSUM Connection

The **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM)** scheme is India's primary programme for solar energy in agriculture:

COMPONENT	PURPOSE
Component A	10,000 MW of decentralised solar power plants on barren/fallow land
Component B	20 lakh standalone solar pumps
Component C	Solarisation of 15 lakh grid-connected agricultural pumps
Budget 2026-27	Rs 5,000 crore (nearly doubled)

AgriPV can be integrated into PM-KUSUM Component A, allowing farmers to earn from both farming and selling solar power — becoming "Urjadatas (energy providers) alongside being Annadatas (food providers)."

Global AgriPV Experience

COUNTRY	STATUS	KEY ACHIEVEMENT
Japan	Pioneer (since 2004)	2,000+ AgriPV installations
France	Regulatory framework since 2023	Mandatory AgriPV for ground-mounted >10 MW
Germany	Fraunhofer ISE research hub	30% water savings demonstrated
China	Largest installed base	20+ GW AgriPV capacity
Italy	EU funding for AgriPV pilots	Wine and olive cultivation under panels

Benefits Beyond Energy

1. **Farmer income diversification** — Dual revenue from crops and electricity
2. **Water conservation** — 15-30% reduced evaporation
3. **Crop protection** — Panels provide shelter from hailstorms and extreme heat
4. **Grid stability** — Distributed generation reduces transmission losses
5. **Climate resilience** — Partial shading moderates soil temperature during heatwaves

Challenges

- **High upfront cost** — Elevated structures cost 20-30% more than conventional ground-mount
- **Crop-panel optimisation** — Not all crops thrive under partial shade
- **Financing** — Small farmers lack access to capital for solar investment
- **Grid connectivity** — Rural grid infrastructure often inadequate for power evacuation
- **Land ownership** — Fragmented holdings complicate large-scale deployment

UPSC RELEVANCE

PM-KUSUM components, India's solar target (300 GW by 2030), AgriPV technology.

MAINS GS-3:

Energy security vs food security trade-off; renewable energy and agricultural integration; technology solutions for climate adaptation.

📌 FACTS CORNER — KNOWLEDGEPEDIA

AGRIPV TECHNOLOGY:

Concept: Solar panels elevated above farmland, crops grow below

Panel height: 3-5 metres

Water savings: 15-30% reduced evaporation

Suitable crops: Leafy greens, herbs, pulses, some cereals

Global leader: China (20+ GW installed)

PM-KUSUM SCHEME:

Full form: Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan

Launched: 2019

Budget 2026-27: Rs 5,000 crore

Component A: 10,000 MW solar plants

Component B: 20 lakh solar pumps

Component C: 15 lakh pump solarisation

INDIA'S SOLAR SECTOR:

Current installed solar: ~100+ GW (2025)

Target 2030: 300 GW solar (part of 500 GW non-fossil target)

India Solar Alliance (ISA): HQ in Gurugram, India

National Solar Mission: launched 2010 under NAPCC

NATIONAL AGRI-PHOTOVOLTAICS MISSION (PROPOSED):

Target: 10 GW AgriPV capacity

Rationale: Resolve food-energy land conflict

Concept: Farmers as Urjadatas + Annadatas

OTHER RELEVANT FACTS:

India's NDC: 50% cumulative electric power from non-fossil sources by 2030

Net Zero target: 2070

Rooftop solar scheme: PM Surya Ghar (launched 2024, 1 crore households target)

> India’s land under agriculture: ~52% of geographic area

Sources: Indian Express , Insights on India

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