



BAIF Development Research Foundation

Committed to Sustainable Development of Rural India

Integrated Agrivoltaics Systems: Innovations, Impact and Development Insights

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Programmes and Outreach

PROGRAMMES

Livelihoods

Livestock Based Livelihoods | Farm Based Livelihoods
Water Centric Livelihoods | Rural Non-Farm Sector Based Livelihoods



Social Enterprises



Research & Incubation



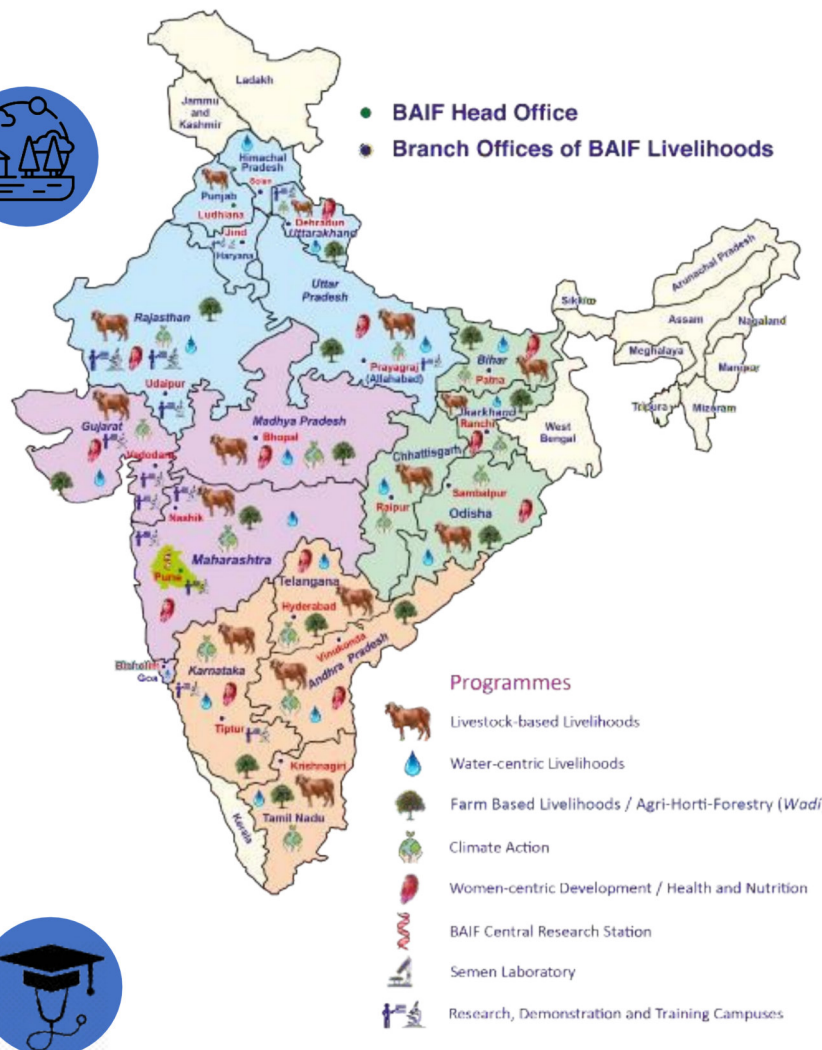
Climate Action



Women Centric Development



Health and Education



OUTREACH

18 States

397 Districts

70 Aspirational Districts

1.15 Million Villages

5.0 Million Families

BAIF's Operational Domains in RE and Strategic Opportunity

Operational Domains

- Solar Energy and Micro grids
- Livestock and Bioenergy Systems
- Biomass Feedstocks and Biochar Protocols
- Carbon Farming and Circular Ecosystems
- Climate Smart Village Solutions
- Community and Rural Energy
- Blended Finance and Digital MRV

Relevance for Action



Massive Untapped Potential and in alignment with climate goals and NDC's



Farmer Income Diversification, New Rural Economy & Jobs.



Climate Resilience and Microclimate Benefits



Total land required for non-fossil power sources ~2.0M – 2.5M Acres



Agrivoltaics is promising solution combines both energy and food production



ESG & SDG Alignment and Green rural livelihoods

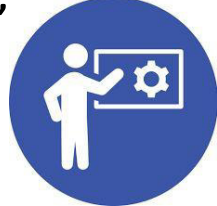


Integrated Agrivoltaics System: Project at Glance

- BAIF Development Research Foundation developed 17 agrivoltaics models with 13 distinct structural designs with 5 energy uptake models implemented across three agro-climatic regions (Maharashtra, Karnataka and Telangana) with a total capacity of 1233 kWh.
- Cultivated and evaluated 30 crops under solar panels to assess crop performance alongside energy generation.
- Currently developing crop-wise economic analysis and package of practices to assess the model's economic viability and scalability at farmer level.
- Capacity building through technical trainings and awareness generation to 1000+ farmers, 107 and 6 FPO members from three states of India.



Dual Use of
Land



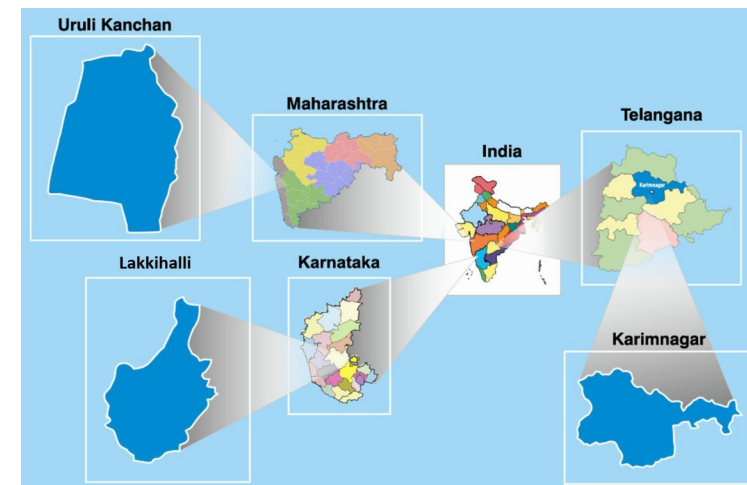
Capacity
Building



Increase
awareness



Scientific
knowledge
development



Integrated Agrivoltaics –Models and Uptake

Poly tunnel



Polyhouse with Flexible PV



Floating PV in Farm pond



Roof top PV on Cattle shed



Fix tilted 1.0 m, 1.5 m, 1.8 m



Single axis Auto tracking



Vertical model



Elevated model 1



Elevated model 2



Power to Polyhouse



EV Tractor Charging



Power to RO Plant



Power to Irrigation Pumps



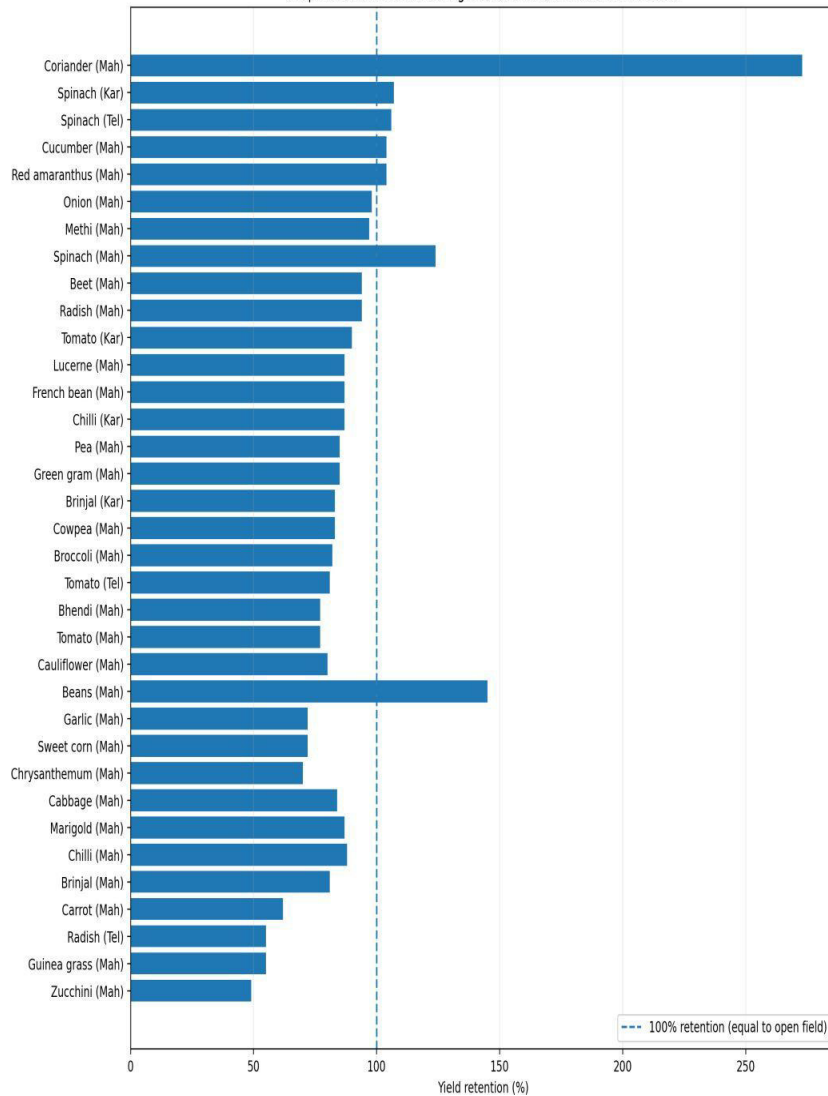
Power to Street Light



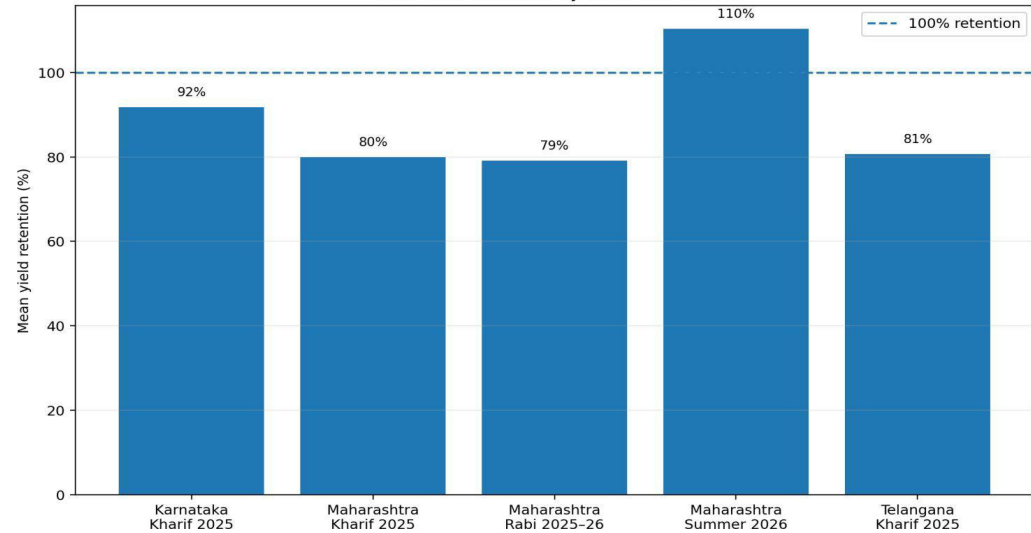
Modular Energy Storage System



Crop Yield Retention under Agrivoltaics Across Three Indian States



Mean Yield Retention by State and Season



- Mean crop yield retention under agrivoltaics varies by state and season ranging from 79% to 92% in Kharif and Rabi seasons, but peaking at 110% in Summer 2026.
- Select crops like Coriander, Beans and Spinach achieve excellent yield gains.
- Across Kharif 2025, Rabi 2026, and Summer 2026, AV demonstrated variable crop yield retention, ranging from 49% to 273%
- The yield differences varied by season and crop, indicating that crop response to AgriPV conditions is influenced by seasonal factors and system configuration.
- Average yield retention by 80%, 81% and 110% observed in Kharif, Rabi and Summer respectively.

Innovation and Development Insights

Different Intervention with Agri PV



Solar + Battery Investment



Annual Saving



Payback period



Annual CO₂ Emission Reduction

Agri PV with Cold Storage

₹10.33 lakh

₹2.7 lakh

3.8 years

14.35 tonnes Per year

Agri PV with Poly Tunnel 10 kW

₹8.68 lakh

₹2.8 lakh

3.1 years

15 tonnes Per year

Agri PV with EV Tractor

₹21.80 lakh

₹6.4 lakh

3.4 years

18 tonnes Per year

Agri PV with Irrigation Pump

₹19.14 lakh

₹5.5 lakh

3.4 years

9 tonnes Per year

Demonstrated at BAIF Rural Innovation Centre (BRIC) – Pune, Maharashtra



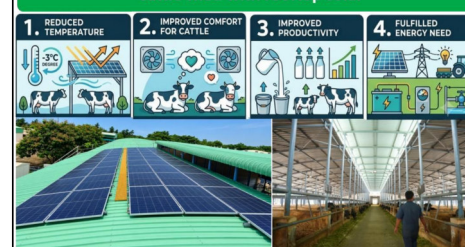
Agrivoltaics with Climate smart village model



Agri PV – Polytunnel model



Cattle shed with rooftop solar



Green jobs for 27 youth and women members

Emission Reduction 56.35 tonnes Per year

Payback Period with Agri PV System per annum

Agrivoltaics models	Solar Installation cost (Rs/ha)	Crop Cultivation cost (Rs/Ha)	Total Cost (Rs/ Ha)	GMR from energy+ Crop (Rs/Ha)	NMR from energy + Crop (Rs/Ha)	Payback period (years)
Fix tilted 1.0 m ground clearance	3,26,25,000.00	5,97,792.80	3,32,22,792.80	10642523.70	9144730.80	3.57
Fix tilted 1.5 m ground clearance	3,63,75,000.00	5,44,652.30	3,69,19,652.30	10636918.90	9192266.60	3.89
Fix tilted 1.8 m ground clearance	3,80,19,000.00	5,95,701.50	3,86,14,701.50	10079826.65	8683725.16	4.38
Inclined Single axis - Auto tracking	4,16,40,500.00	4,15,491.70	4,20,55,991.70	7878454.50	6862962.90	6.07
Horizontal Single axis- Auto Tracking	4,16,40,500.00	4,64,178.00	4,21,04,678.00	7498727.10	6434549.10	5.98
Seasonal Tracker	5,32,84,322.00	3,07,483.90	5,35,91,805.90	10079233.70	8905349.8	6.02

Key Highlights and Insights

- The crop productivity varies with season and crop in the range of **79% to 110%** against the control.
- The income ratio for energy and crop production is observed as **94:6**.
- The overall land productivity goes up by **1.64 to 1.71** times compared to the control depending on crop type, shading level, and system design
- Fastest Payback Period: Fix tilted 1 m (**3.57 years**) followed by Fix Tilted 1.5 m (**3.89 years**).
- Highest Annual Return Rate (NMR / Total Cost): Fix Tilted 1 m at **28%**, followed by Fix Tilted 1.5 m at **24.90 %**.
- Highest Net Annual Revenue: Fix Tilted 1.5 m generates the highest net monetary return at **Rs 91.92 Lakhs/Ha/year**, closely followed by Fix Tilted 1 m at **Rs 91.44 Lakhs/Ha/year**.
- Capital Intensive Structure : Vertical PV has the highest total cost (**Rs 6.09 Crores/Ha**) and tracking system (**Rs 4.16 Crores /Ha**).
- The losses in generation are observed in the range of **8% to 19%**.

Green jobs and rural livelihood opportunities



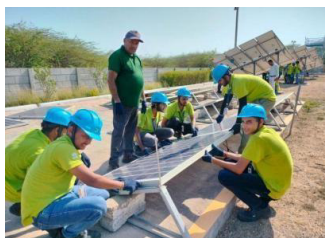
1) Solar installation and maintenance

Structure installation, panel cleaning, inspection, electrical maintenance and system monitoring.



2) Agrivoltaics farm management

Women farmers in Agrivoltaics for crop planning, nursery raising, irrigation management, harvesting and crop-quality monitoring.



3) Technical training and entrepreneurship

Local service providers, solar technicians, irrigation operators and agrivoltaics advisory services.



4) Diversified rural enterprises

EV charging stations, High-value crop cultivation under hydroponics, livestock-based enterprises and other locally suitable activities.

Training and awareness program for 60 diploma students from Industrial Training Institute and Minimum competency Vocational courses for creating green jobs

Green job category	Skills required	Potential local opportunity	Jobs created
Solar technician	Installation and maintenance	Skilled employment	5
AV farm operator	Crop and irrigation management	Farm-based employment	15
Protected cultivation operator	Hydroponics and crop management	High-value production	2
Rural service entrepreneur	Technical services and coordination	Self-employment	5

AV Adoption: Challenges & Way Forward

KEY ADOPTION CHALLENGES

01

High upfront investment

Capital costs and uncertain returns limit smallholder access.

02

Lack of crop- and region-specific AV standards

Crop, shade, structure and local conditions need validation.

03

Limited access to finance and lac of policy

Leasing, credit, ownership and approvals can be complex.

04

Skills & local service support

Farmers need training, maintenance and trusted guidance.

WAY FORWARD

01

Flexible finance & partnerships

Blend grants, credit, FPO contributions and private investment.

02

Co-design and field validation

Test crop–structure combinations and share clear performance data.

03

FPO / CSO-led aggregation

Pool demand, enable shared assets and simplify implementation.

04

Build a local support ecosystem

Train farmers, youth and technicians; link energy to enterprises.

SUCCESS FACTOR • Farmer-centred design + reliable evidence + inclusive finance + local ownership

Thank you....!