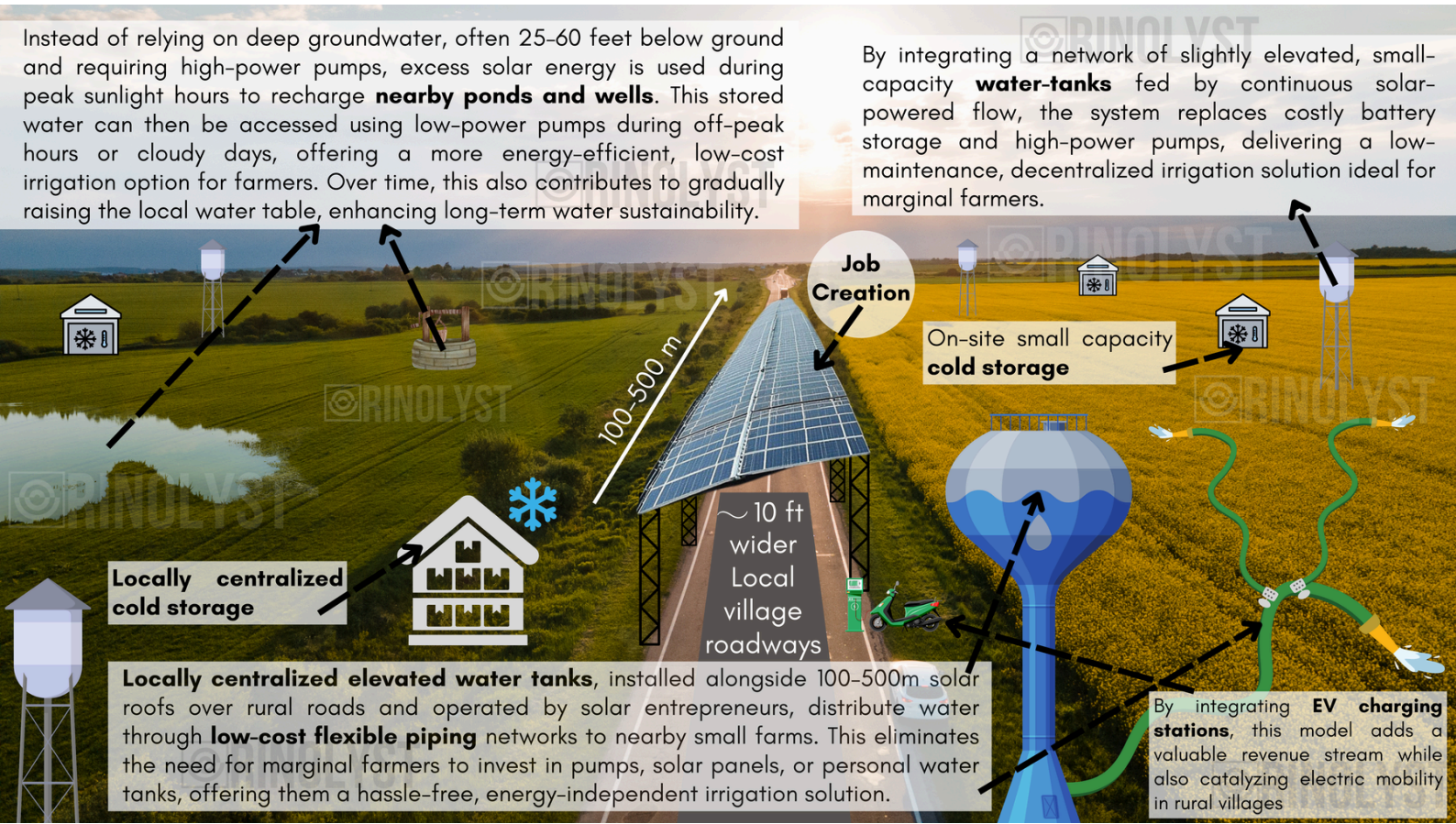
RINOLYST

VISION FOR BIHAR
AGRIVOLTAIC
INNOVATIVE PATHWAYS TO NET ZERO

REIMAGINING AGRIVOLTAICS FOR FARMERS IN BIHAR

Bihar's agriculture faces significant challenges. Nearly 90% of farming households are marginal, operating on small landholdings with limited capital. Farmers contend with unreliable energy access and a heavy dependence on deep groundwater extraction, often from depths of 25 to 60 feet, for energy-intensive pumping, which drives a major share of the state's net electricity consumption. Moreover, many farmers are still awaiting reliable electricity connections for agricultural activities. In light of these land, economic, and water management constraints, it is critical to adopt a sustainable, renewable approach that meets Bihar's pressing needs. While traditional agrivoltaic models combine solar energy with agriculture, they often demand dedicated farmland, significant upfront investment, and reliance on on-grid connectivity or battery backups. Although these systems can be effective in some contexts, their viability is limited for smallholder farmers due to stringent land and financial constraints. RINOLYST introduces a pilot-scale conceptual model that is contextually adaptive, operationally effective, and economically accessible, particularly attractive to marginal farmers in Bihar and other regions of the Indo-Gangetic Plain. Our solution leverages elevated solar structures installed over underutilized rural roadways and similar spaces, thereby preserving valuable farmland and enabling scalable private and local ownership. Rather than continuously relying on deep groundwater extraction, our system harnesses surplus solar energy during peak sunlight to recharge locally installed elevated water tanks, both as distributed networks and centralized units. The stored water then replenishes nearby hydrological bodies, whether drawn from groundwater or adjacent canals, creating a natural energy buffer that functions like a battery. This innovative approach significantly reduces pumping costs and carbon emissions, simplifies operations and maintenance, eliminates the need for expensive chemical battery storage, and ensures consistent, low-power irrigation during off-peak hours and cloudy days. The modular design features automated, rail-based solar panel movement for enhanced longevity and reduced maintenance, while simplified interfaces empower local operators, sparing farmers from technical burdens. Beyond irrigation, our model integrates rural on-site cold storage, EV charging, and eventually aqua-farming to unlock multiple revenue streams and foster a circular rural economy. Technically robust and economically sound, this transformative solution is tailored to Bihar's unique agricultural ecosystem.

RINOLYST LAB'S PILOT AGRIVOLTAIC MODEL FOR BIHAR: A FULLY RENEWABLE, SELF-SUSTAINING FARMING SOLUTION



Traditional Model	RINOLYST's Model – Key Highlights
High Land & Capital Barriers: Conventional systems require dedicated farmland and significant upfront investments, which marginal farmers (≈90% of Bihar's farming households) cannot afford.	**Optimized Land Use & Distributed Ownership:** By using underutilized rural roadways for elevated solar roofs, our model conserves valuable farmland and offers scalable, community-friendly ownership options.
Reliance on Deep Groundwater Pumping: Traditional setups depend on high-power pumps to extract water from deep aquifers (25-60 ft), resulting in high energy costs.	**Energy-Efficient Water Recharging:** Surplus solar energy recharges nearby ponds and wells, providing water that can be pumped with low-power units, significantly reducing energy costs.
Dependence on Grid Connectivity: On-grid systems often destabilize the network during peak production, and costly battery storage is needed for off-grid backup.	**Robust Off-Grid Functionality:** Our system is designed to work effectively off-grid, using natural water storage as an energy buffer to minimize grid imbalance and avoid expensive battery systems.
Short-Term System Longevity: Isolated installations (solar panels with individual pumps) often suffer from maintenance issues and inconsistent usage over time.	**Long-Term, Modular Design:** The modular, elevated solar structure paired with automated maintenance (e.g., movable panels on rails) ensures prolonged, reliable operation with lower upkeep.
Limited Revenue Streams: Traditional models focus solely on power generation for irrigation, missing out on additional income channels.	**Multi-Synergy Revenue Generation:** Our integrated approach supports cold storage, aqua-farming, and EV charging, creating diversified income streams while enhancing overall farm productivity.
Low Technological Adoption: Farmers often lack the skills or digital literacy to manage advanced solar installations and maintenance systems.	**Simplified, User-Friendly Systems:** With a design that minimizes complex technology, local operators manage the systems, freeing farmers from technical burdens and ensuring ease of use.
Exclusive Focus on Electricity for Irrigation: Conventional models typically force farmers to invest in both solar panels and high-power pumps, even when only water is needed for irrigation.	**Flexible Energy & Water Delivery:** Our model allows farmers to choose between purchasing solar electricity or simply accessing water from pre-charged, elevated tanks. This flexibility minimizes the need for individual pumps, solar panels, or water tanks, making it a cost-effective and tailored solution.

A win-win situation to all

Farmers: Offers multiple/flexible, cost-effective energy and water options regardless of land and economic constraints, empowering all farmer categories.

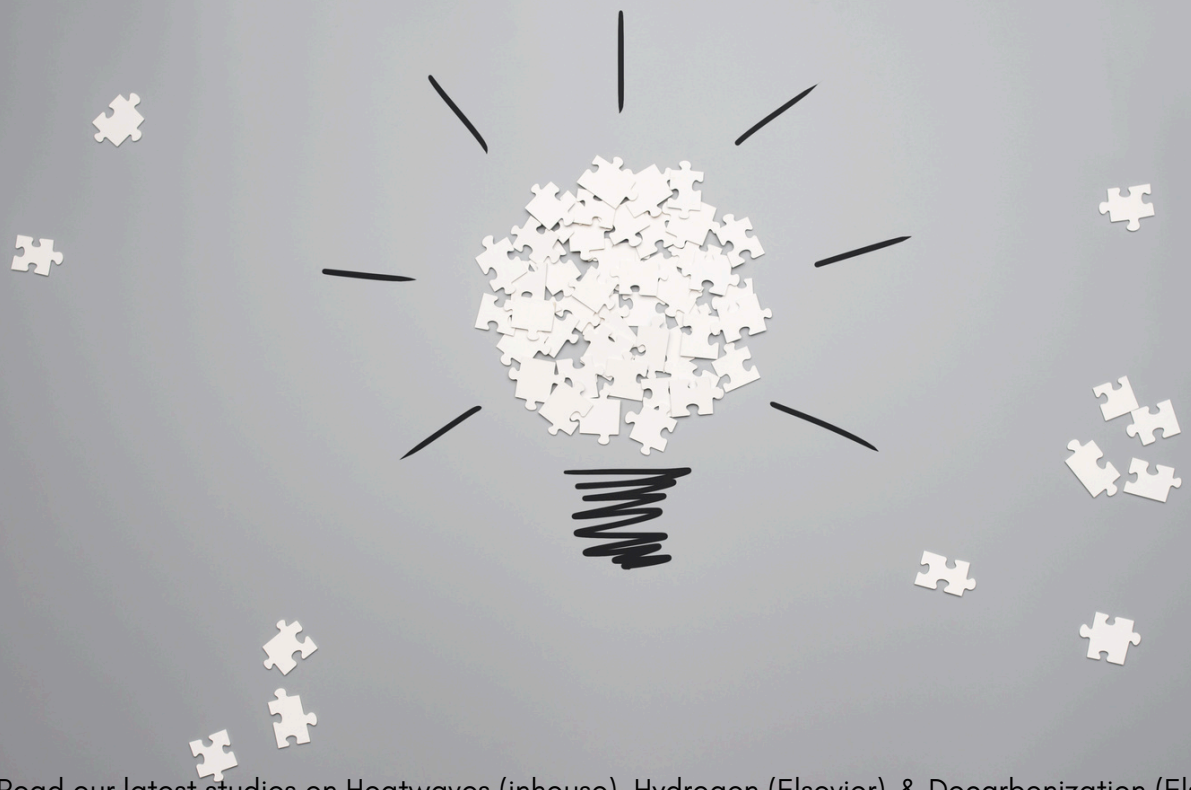
Solar-Based Companies: Facilitates rapid, aggregated deployment with simplified maintenance and reduced logistics, unlocking high-volume business potential.

Government & Policy Makers: Enables fast, scalable deployment that accelerates net-zero targets, builds high farmer trust, and advances sustainable agriculture policies.

Water Management Institutions: Promotes efficient water conservation and management through integrated systems that recharge local water bodies and reduce deep groundwater reliance.

Local Entrepreneurs: Creates robust business opportunities in owning, managing, and maintaining integrated Agrivoltaic systems with diversified revenue streams.

Other Business Owners: Supports development of renewable-powered cold storage, agro-processing, and EV charging infrastructure, contributing to broader net-zero and rural economic goals.



Read our latest studies on Heatwaves (inhouse), Hydrogen (Elsevier), & Decarbonization (Elsevier)

At RINOLYST, we are exploring integrated and flexible Agrivoltaic solutions to develop a fully renewable, self-sustaining farming model for Bihar that transforms agriculture, rural energy, and water management. Recognizing the critical importance of climate resilience and sustainable practices, we believe that fruitful collaboration is essential to drive this transformation. We welcome policymakers, industries, institutions, communities, and individuals to join us on this pivotal journey. Every initiative at RINOLYST is grounded in scientific integrity, driven by rigorous research and robust data, and propelled by our unwavering commitment to accelerating progress through research that matters.

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