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Global Energy Alliance for People and Planet
GEAPP

Empowering Rajasthan's Agriculture through Solar Power

A Glimpse into GEAPP's Impact under PM-KUSUM in Rajasthan

Clean Energy | Better Livelihoods | Brighter Futures

Powering Progress: The Rajasthan Story

Rajasthan has always been challenged by irregular electricity supply with a huge dependence on fossil fuels for agriculture. However, now it is visibly transforming into a renewable energy hub, especially through solar power. Some of the solutions that the state has put in place to tackle issues in the water-energy-agriculture nexus are quite innovative. As a result, in the last five years, around 131,000 solar-powered irrigation pumps have been installed[1]. In regions like Kotputli-Behror, 20,000 farmers have already adopted solar irrigation, while statewide installations grow at 225 connections daily. This transition is reducing the state's agricultural power subsidy burden by nearly 60%[2] while increasing renewable energy generation. Solar and wind energy are growing, now catching up to fossil fuel generation. With ambitious targets of 30 GW solar capacity by 2024-25[3], Rajasthan is on its path to a revolution in rural energy access that's changing the agricultural landscape.

One of the key reasons for this is the launch of the Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM KUSUM) scheme by the Government of India to transform power supply in the agricultural sector using solar power ensuring that the power is more consistent, reliable and affordable for farmers. Due to its immense solar potential, Rajasthan has emerged as a leader in this. The Global Energy Alliance for People and Planet (GEAPP) has played a catalytic role in Rajasthan's solar journey, offering both technical and financial support to accelerate the adoption of clean energy in agriculture. In doing so, it is helping electrify not just farmlands, but farmers' futures.

Consistent and reliable solar power allows farmers to irrigate their farms during the day. This reduces the dependence on diesel pumps and leads to increased adoption of agricultural practices that are more efficient. Slowly and steadily, these changes have contributed to lower costs of energy and farm schedules that are predictable. In some remote villages, better electricity access is also enabling individuals to start up new small businesses and run existing ones with fewer interruptions. Households have benefited from improved lighting and appliance use. While these are positive changes, there is a lot more this intervention can do in the future from supporting rural livelihoods, increasing women's participation to helping farm systems become resilient to climate change risks.

[1] https://www.business-standard.com/india-news/solar-pump-scheme-helps-29-000-rajasthan-farmers-in-a-year-125010200402_1.html

[2] https://www.eqmagpro.com/kotputli-behror-pioneers-rural-solar-revolution-in-agriculture-eq/

[3] https://rajnivesh.rajasthan.gov.in/Uploads/d64c2541-89cb-44ae-bcd4-a5090c9f59ba.pdf

Charting Rajasthan's Solar Transition

131,000

solar-powered irrigation pumps have been installed across Rajasthan in the last five years.

20,000

farmers in regions like Kotputli–Behror have already adopted solar irrigation systems.

225

new solar connections are being added daily, accelerating the state's clean energy transition.

30 GW

of solar capacity is targeted by 2024–25, positioning Rajasthan at the forefront of India's rural energy transformation.

60%

reduction in Rajasthan's agricultural power subsidy burden has been achieved through this solar shift.

Solar and wind energy now match fossil fuel generation, marking a significant milestone in the state's energy mix.

GEAPP’s Support to PM KUSUM in Rajasthan

To enable a more coordinated and data-driven solar transition in Rajasthan, GEAPP has been supporting the implementation of PM-KUSUM through targeted technical and financial interventions. In partnership with Jaipur Vidyut Vitran Nigam Limited (JVVNL) and other key stakeholders, GEAPP helped conceptualize and roll out a digital Contract Monitoring System (CMS) designed to improve transparency, efficiency, and coordination across the solar project lifecycle.

The CMS was deployed across 18 DISCOM circles. This platform enables real-time tracking of project progress and plant performance, allowing for smoother commissioning, faster issue resolution, and better overall governance of the rollout. As of March 2025, according to the DISCOMs’ CMS Digital Tool, Rajasthan has installed 243 solar plants with a combined capacity of 463 MW, reaching 177,000 farmers, connecting 667,000 households, impacting 3.34 million lives, creating 189,000 jobs, and mobilizing $283 million in funding, $223 million from private sources and $60 million from public investment marking significant strides in energy access, livelihoods, and rural enterprise. Nearly 900 additional projects are still in the pipeline. Beyond system design and deployment, GEAPP has also supported building capacities with over 600 DISCOM personnel trained in the use of CMS and facilitated iterative consultations to ensure it remains aligned with field-level needs. These efforts underscore GEAPP’s catalytic role in modernizing PM-KUSUM implementation and advancing a scalable model for decentralized renewable energy deployment in India.

18 DISCOM circles

have been brought under a unified Contract Monitoring System (CMS) to enhance visibility and coordination in solar project implementation.

600+ DISCOM officials

have been trained to integrate digital monitoring tools into their daily operational workflows.

243 solar plants

have been successfully commissioned with GEAPP’s technical and operational support, as per data from the DISCOMs’ CMS Digital Tool.

GEAPP’s Technical and Strategic Footprint

243
solar plants installed (463 MW)

177,000
farmers reached

667,000
households connected

3.34
million lives impacted

189,000
jobs improved

$283
million in funding mobilized

($223M private + $60M public investment)

Impact on the Ground:
Early Signs Across Rural Life

Sambodhi, in partnership with GEAPP, conducted a study across multiple districts to assess how reliable, solar-powered electricity is reshaping lives in rural Rajasthan under PM-KUSUM. Drawing on field visits, surveys, and interviews with farmers, women, DISCOM officials, and land as well as enterprise owners, the study highlights early, directional shifts in day-to-day life. These shifts can be observed at three interconnected levels: on the farm, within the home, and across the community and local economy.

Access to reliable electricity has significantly improved in areas where solar plants under the PM-KUSUM scheme are operational

In parts of rural Rajasthan where solar plants under the PM-KUSUM scheme are now operational, the arrival of reliable electricity is beginning to change the rhythm of everyday life. For farmers, business owners, and families alike, access to consistent daytime power is making it easier to plan their days, cut costs, and spend more time on what matters. Satisfaction levels among those connected to solar-powered grids are promising as compared to those who weren't. While just 20% of non-users reported being satisfied with their current supply, this figure jumped to 93% among users (figure 1).

Where unreliable power once disrupted work and home life, many now see steady voltage and fewer interruptions. Nearly all users (94%) reported fewer power cuts since the solar plants became operational. Two-thirds (65%) saw a reduction in their electricity bills, and others shared that they now rarely need to rely on costly diesel generators to meet their basic energy needs (figure 2).

a. On the Farm: Reliable Electricity Boosts Productivity

Farmers are also seeing the difference. In a village called Sanoli, a local developer noted how the power that used to alternate weekly between night and day is now consistently available during the day. That means irrigation can be completed on time, before dark, freeing up evenings for rest and family. In Bansur, farmers no longer rely on diesel pumps or stay up late to irrigate their fields, thanks to the growing predictability of grid-connected solar energy.

> *Farmers now complete their watering before evening, that never used to happen earlier.*

Behind the scenes, engineers and DISCOM officials describe how solar integration is stabilizing voltage, reducing the burden on transformers, and making it easier to schedule power during peak agricultural hours. These stories reflect a simple but powerful shift. When energy becomes more dependable, people gain time, control, and peace of mind. And when that happens across hundreds of villages, it's not just about electricity anymore, it's about a different way of living.

Powering Smart Farming

With solar energy now reaching their fields during the day, many farmers are beginning to experience a noticeable shift in how they cultivate. Across the surveyed regions, a majority shared that their cost of cultivation has gone down, thanks to reduced reliance on diesel and better-timed irrigation.

More than half of the farmers reported higher yields, and many noted that the physical effort required in the field has reduced. As reliable power becomes the norm, nearly 4 in 10 farmers have begun using electric pumps, sprayers, and other farm machinery, marking a steady move toward more modern, efficient, and less labour-intensive agricultural practices (figure 3).

Users Report Higher Satisfaction and Reliable Power

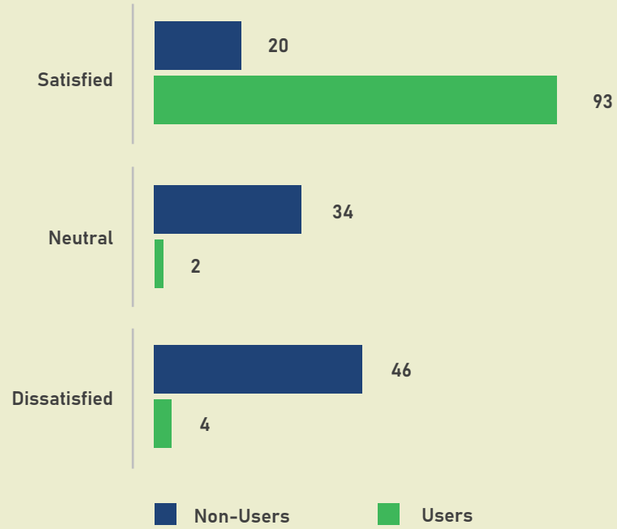

Figure 1: Satisfaction levels with current power supply of Users vs. Non-users (%)

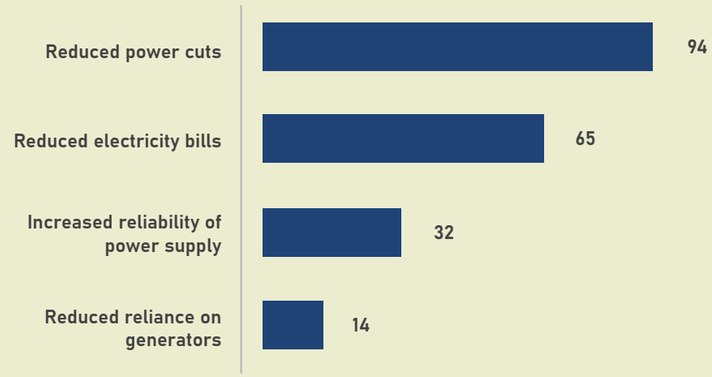

Figure 2: Percentage of users reporting changes in power access post-commissioning

More Choice, More Income: Expanding What Farmers Grow

With access to dependable electricity, farmers are no longer limited by erratic power or rigid irrigation schedules. Many are now diversifying beyond traditional staples to grow more profitable, market-oriented crops such as watermelon, onion, okra (lady finger), spinach, and coriander between the Rabi and Kharif seasons. Reliable daytime power is enabling better planning, timely watering, and longer growing cycles, opening the door to higher returns and more resilient farm incomes.

b. At Home: Time Reclaimed, Dreams Reignited

Overall improvement in quality-of-life experience due to better electricity access.

When electricity becomes reliable, everyday life starts to feel more manageable and more hopeful. In homes across rural Rajasthan, the arrival of a consistent solar-powered supply is making space for small but meaningful improvements.

Children are now able to study for longer uninterrupted hours in the evenings, thanks to dependable nighttime lighting. In areas like Kotputli and Behror, voltage stability from solar-linked substations has meant families are relying less on inverters or kerosene lamps (figure 4).

The ripple effects go beyond the home. In villages like Sawarda and Behror, local shops, flour mills, and welding units are staying open longer, thanks to steady daytime power. As these enterprises grow, they're not only easing household expenses, but they're also strengthening food security and providing a second source of income for many rural families.

Early indication of gendered shifts in power access

With consistent power during the day, many women now complete household and agricultural work earlier and more efficiently. Over 80% of women reported spending less time on chores. Households are also using fans, mixers, and washing machines more regularly, especially during the hot summer months. For women, this often means less time spent on chores and more time for rest, income-generating work, or simply breathing time during the day. These may seem like small shifts, but they carry large symbolic meaning, green shoots of gender change taking root in everyday routines (figure 5).

With more power, comes more possibility

Rina, a woman farmer in Bansur, manages about 8-9 bighas of land owned while her husband works primarily at a local shop. Since the installation of solar power in her area 2-3 years ago, she has taken full charge of the agricultural activities. With improved electricity supply, she has diversified her crop mix to include watermelon, ladyfinger, and onions in addition to traditional seasonal crops. Her monthly income has increased from ₹40,000-50,000 with a remarkable 60% rise. Her story reflects how women farmers, when enabled with reliable power, can lead agricultural innovation and income generation at the household level.

Now electricity stays on throughout the night, so children can study comfortably," said Santosh from Sanoli village. Her family has experienced a significant improvement since uninterrupted power started.

Earlier, the 3-phase supply was provided alternately, one week at night and the next week during the day. Now, since it is consistently available during the day, we no longer need to go to the fields at night.

- Farmer, Amarpura

Solar Power Is Boosting Yields and Shifting Roles

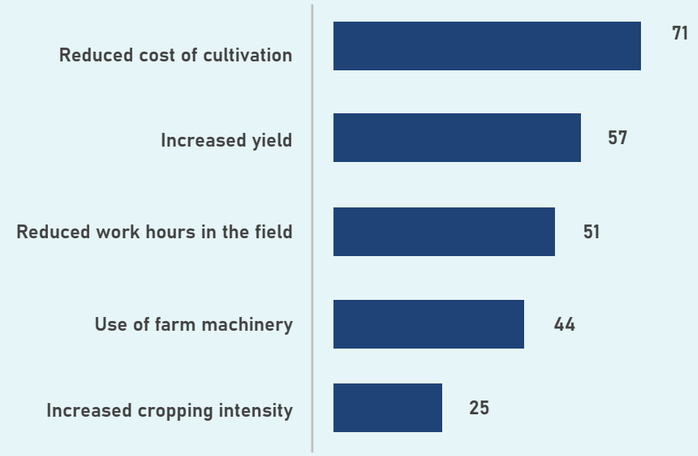

Figure 3: Percentage of users who witnessed change in agricultural practices

81%

of households reported longer study hours for children due to consistent lighting.

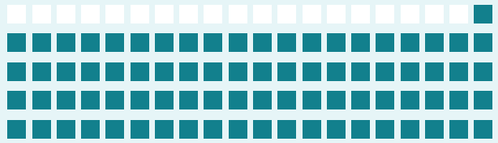

Figure 4

Women are experiencing more rest time, opportunities for income generation, and greater independence in managing household energy use. Women are gaining greater control over how and when appliances are used, contributing to a gradual but significant shift in gender roles within the home.

Access to power is also improving safety, dignity, and autonomy.

82%

of women reported spending less time on household chores given the accessibility of fans, mixers, and washing machines.

Figure 5

c. In the Community: Local Economies Spark to Life

Access to reliable electricity has long been linked to stronger rural economies. Global studies, including those by the United Nations and The Rockefeller Foundation, show that energy access can contribute to higher incomes, longer work hours, and the growth of small businesses[4]. But these gains don't happen in isolation, they are meaningful when combined with local solutions, access to credit, and infrastructure support. In Rajasthan, solar-connected grids are beginning to set this transformation in motion. While widespread job creation will take time, early signs of progress are emerging. From welding shops to flour mills, solar power is giving small businesses the confidence to stay open longer, increase productivity, and even expand. In the village of Sawarda, consistent electricity has helped revive a cluster of local enterprises. Saleem Khan, who runs a welding shop, says his productivity has nearly doubled since solar came in, enough to begin planning a second unit. In the same village, a solar panel assembly unit now employs seven workers, and several local shops have extended their hours by two to three hours daily.

Rural institutions are also seeing the benefits. In schools, teachers report fewer disruptions and more stable voltage during the hot summer months. In some communities, electrified halls and government offices are now offering dependable services, small but visible improvements that signal broader potential. Employment opportunities are also emerging through the solar infrastructure itself.

These may be early days, but the direction is promising. With consistent energy, villages are beginning to unlock economic potential through longer business hours, stronger public services, and meaningful local jobs. Reliable power isn't just supporting livelihoods. it's helping shape the foundations of rural prosperity.

As electricity supply improves, I want to start something small here, maybe a spice grinding unit or a flour mill. There's nothing like that nearby, and it'll help everyone

- Ajeet Kumar, farmers from Jakhrana village

Earlier, the voltage at the school used to be low, but now it has stabilized. Even the fans run faster now.

- Teacher, Sawarda

[4] United Nations-The Economic and Social Commission for Asia and the Pacific (ESCAP). 2021. https://www.unescap.org/sites/default/d8files/knowledge-products/Systematic-Review-of-the-Socio-economic-Impacts-of-Rural-Electrification%2026%20Feb.pdf

Looking Ahead: Enabling an Inclusive Energy Future

Rajasthan's experience under the PM-KUSUM scheme offers an early but compelling glimpse into what clean energy can achieve when paired with strong public systems and community engagement. Reliable solar power is helping farmers irrigate on time, households savings on fuel and bills, women finding time for income-generating activities, and rural enterprises extending their working hours. These are small shifts but together, they signal a broader transformation in how energy touches daily life.

This study points to meaningful gains across farms, homes, and local economies. Solar-connected grids are helping reduce diesel dependence, improve crop yields, and bring comfort and dignity to rural households. Importantly, women are stating increased participation in energy-related decisions and a greater sense of safety and control.

Digital innovation has played a catalytic role. The CMS, now active across 18 DISCOM circles, is helping streamline project implementation and equipping over 600 staff to manage solar assets more efficiently. Yet, as the initiative grows, sustaining and scaling these early wins will require continued investment in frontline capacity, improved feeder infrastructure, responsive digital systems, and stronger coordination among stakeholders.

There is also a need to embed long-term learning systems, tools that go beyond tracking outputs to capturing outcomes and adapting to challenges in real time. With a strong foundation already laid, Rajasthan has the potential to lead not just in solar deployment but in building an inclusive, resilient, and future-ready rural energy model. As India advances its renewable energy targets, Rajasthan is showing what becomes possible when clean energy is delivered with intent and inclusion.

Solar energy is no longer just about kilowatts, it's about reclaiming time, safety, and opportunity.

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