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CONTENT

BUSINESS NEWS

SUCCESS STORY

COMPANY FEATURE

PRODUCT LAUNCH

PRODUCT FEATURE

PROJECT FEATURE

TECH INSIGHTS

SOLARQUARTER RESEARCH

SOLARQUARTER STORY

THE CHAMPIONS CORNER

SOLAR QUARTER PRESENTS

SOLAR & STORAGE CONFEX 2025 MADHYA PRADESH

ENERGY EXCELLENCE AWARDS

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INDIA SOLAR NEWS

Policy & Regulatory >

PM-Surya Ghar: Muft Bijli Yojana Launches Nationwide Campaign To Promote Rooftop Solar Adoption

The Government of India's PM-Surya Ghar: Muft Bijli Yojana, launched with ₹75,021 crore, aims to equip one crore households with rooftop solar systems by 2026-27. MNRE has allocated ₹657 crore for a nationwide awareness campaign using TV, print, digital, and local outreach to simplify technical information and encourage participation. Overseen by the Awareness and Outreach Committee, the campaign ensures coordinated execution through NPIA and state agencies, promoting solar adoption and empowering households toward a cleaner, self-reliant energy future.

CEA Proposes Draft Regulations To Strengthen India's Power Infrastructure And Cybersecurity

The Central Electricity Authority (CEA) has issued two draft regulations to enhance India's power sector safety—one focusing on technical standards for constructing electrical plants and lines, and the other on cybersecurity. The amendments strengthen material testing, durability, and corrosion resistance, while the cybersecurity rules mandate audits, reporting, and protection of operational systems. Stakeholders can submit comments by November 7, 2025. These measures aim to ensure India's power infrastructure is secure, reliable, and future-ready.

UPPCL Seeks Approval For 1,600 MW Solar Power Deals Amid UPERC Scrutiny In Uttar Pradesh

Uttar Pradesh Power Corporation Ltd. (UPPCL) has sought regulatory approval from UPERC for four solar Power Purchase Agreements totaling 1,600 MW, signed with NTPC Renewable Energy, Adani Green, and ReNew Green. The Commission raised concerns over delays in signing the PPAs after the January 2025 e-auction. UPPCL must submit detailed documents before the next hearing on November 4, 2025. If approved, these projects will significantly boost Uttar Pradesh's solar capacity and reinforce transparency in renewable energy procurement.

CSERC Directs Proper Settlement Of Prosumers' Excess Solar Energy Under Revised Time of Day Tariff In Chhattisgarh

The Chhattisgarh State Electricity Regulatory Commission (CSERC) resolved a dispute over excess solar energy settlement under the revised Time of Day (ToD) tariff. Prosumers faced losses as solar generation coincided with the lowest tariff period. CSERC directed CSPDCL to adjust excess energy in the next lower tariff block, effective retroactively from June 1, 2024. This order ensures fair compensation, protects prosumers from financial loss, and strengthens confidence in Chhattisgarh's renewable energy and net metering framework.

INDIA SOLAR NEWS

Think Tank >

India Surges Ahead In Clean Energy: Solar Power And Manufacturing Drive Record Renewable Growth

India's renewable energy capacity reached 242.6 GW by August 2025, ranking fourth globally and achieving 50% non-fossil capacity five years ahead of target. Solar energy leads with 123 GW, growing 132 times since 2015, supported by the PLI Scheme and ALMM. Wind capacity stands at 50 GW, with rising exports. Despite domestic progress, U.S. tariffs have hindered solar exports. Green Hydrogen is emerging as a key focus, with major investments from Adani, JSW, and L&T. Strong policy support and industry growth are steering India toward a clean, self-reliant, and globally competitive renewable future.

Global Renewable Power Capacity Set to Double by 2030 Despite Supply Chain and Policy Challenges: IEA

The IEA's "Renewables 2025" report projects global renewable capacity to more than double by 2030, adding 4,600 GW—driven mainly by solar PV, accounting for nearly 80% of growth. India is set to become the second-largest market after China. Despite strong momentum, offshore wind faces slower growth due to policy shifts and inflation. Supply chains remain highly dependent on China, posing diversification challenges. Renewables in transport and heating will rise modestly by 2030. The IEA emphasizes grid upgrades, storage, and flexibility to ensure reliable integration as the clean energy transition accelerates worldwide.

Bringing Fusion Energy To The Grid: The Next Frontier In Clean Power Transition – Kleinman Centre For Energy Policy

Fusion energy, powering the sun, offers limitless, carbon-free electricity with no meltdown risk. Recent milestones, including net energy gain at the National Ignition Facility and advances in superconducting magnets, have boosted private and commercial interest, with companies like Google and Microsoft signing PPAs. Magnetic confinement and inertial confinement fusion are leading approaches, supported by the 2024 ADVANCE Act, clarifying licensing. Key challenges remain: public investment in R&D and workforce, high initial costs, and public perception. With global collaboration, strategic funding, and policy support, fusion could complement renewables, providing reliable baseload power and advancing a net-zero, energy-secure future.

SBICAPS Report Highlights India's Battery Storage Sector At Crossroads With Growth, Risks, And Global Lessons

The SBICAPS report highlights India's battery energy storage (BESS) sector amid volatile spot markets, policy reforms, and global lessons. Lithium-ion costs are falling, enabling four-hour projects aligned with evening peaks, yet land, connectivity, and battery performance challenges delay timelines. India lags in domestic manufacturing, relying on imports, unlike China's integrated model with diversified revenue streams. Nearly 30 GW of capacity by FY27 could shift shortages to oversupply, pressuring high-cost projects. Sustainable growth requires ancillary service pricing, merchant revenues, and upstream integration. Execution capability, cost reduction, and market diversification will determine winners in India's evolving BESS landscape.

Andhra Pradesh Poised To Lead India In Agrivoltaics With 2030 Mission

Andhra Pradesh is exploring agrivoltaics to reduce the ₹10,500 crore agricultural electricity subsidy and boost farmer incomes. The "Potential of Agrivoltaics in Andhra Pradesh" blueprint envisions a 500 MW Agrivoltaics Mission 2030, leveraging 14.7% wasteland and 49.55 lakh hectares of farmland. Farmers could earn ₹40,000–₹50,000 per acre annually, with revenues of ₹15–18 lakh per MW under developer or FPO models. While capital costs are 20% higher than conventional solar, clear tariffs and CAPEX benchmarks are essential. The SAMPADA framework provides regulatory and financial guidance. Successful implementation could position the state as a national leader in food-energy convergence.

INDIA SOLAR NEWS

Think Tank >

India's Nuclear Push Aims For 100 GW By 2047 To Secure Low-Carbon Energy Future

India has unveiled a roadmap to achieve 100 GW of nuclear energy capacity by 2047 under the "Viksit Bharat" mission, marking a major step toward energy security and clean power. Supported by the 2025 Union Budget's Nuclear Energy Mission, the plan includes key reforms to the Atomic Energy Act and Civil Liability for Nuclear Damage Act, enabling private and foreign participation. Challenges include fuel supply, financing, and regulatory efficiency. The government aims to attract investments, foster innovation, and develop indigenous reactor technology. With timely reforms and execution, India's nuclear expansion could ensure a reliable, low-carbon energy future.

India Strengthens Its Solar Lead with 127 GW Installed and 29.46 GW Added In 2025

India's solar energy capacity reached 63.89 GW as of January 2023, making it the largest contributor to the country's 121.54 GW renewable energy mix. Despite COVID-19 challenges, solar installations grew steadily, supported by government incentives, solar parks, and falling generation costs—down 79% in a decade. Solar accounts for 53% of total renewables, followed by wind at 41.98 GW. With a 2030 target of 450 GW of renewables, including 280 GW from solar, India is advancing rapidly toward clean energy and its 2070 net-zero goal.

India Surges Ahead In Clean Energy: Solar Power And Manufacturing Drive Record Renewable Growth – Rubix Data Sciences

India's renewable energy capacity reached 242.6 GW by August 2025, ranking fourth globally and achieving its 50% clean energy milestone five years early. Solar leads the transition with 123 GW installed, a 132-fold increase since 2015, supported by ALMM and PLI schemes that boosted module manufacturing to 100 GW. Wind power stands at 50 GW, with rising turbine exports. The country is also advancing small hydro and bioenergy reforms while promoting Green Hydrogen under the National Mission, targeting 10% of the global market. With strong policy, investments, and innovation, India is accelerating toward a sustainable, self-reliant energy future.

Global Renewable Power Capacity Set to Double by 2030 Despite Supply Chain and Policy Challenges: IEA

According to the IEA's Renewables 2025 report, global renewable power capacity is projected to more than double by 2030, adding 4,600 GW—equal to the combined capacity of China, the EU, and Japan. Solar PV will drive nearly 80% of this growth, supported by falling costs and policy incentives. India is set to become the second-largest growth market after China. Despite supply chain and grid challenges, renewables' resilience remains strong. The report calls for greater investment in grid infrastructure and diversification. Renewables' role in transport and heating will also rise modestly, reinforcing global progress toward clean energy goals.

Bringing Fusion Energy To The Grid: The Next Frontier In Clean Power Transition

Fusion energy, which powers the sun, is emerging as a potential limitless clean power source. Recent breakthroughs, such as NIF's net energy gain and advances in superconducting magnets, have boosted global confidence. Over 53 startups have raised $9.7 billion, led by Commonwealth Fusion Systems, targeting grid-scale power by the 2030s. The 2024 ADVANCE Act eased fusion licensing, promoting private investment. However, challenges remain—high costs, limited tritium supply, and workforce gaps. With coordinated public–private investment, global collaboration, and clear communication, fusion could soon deliver safe, carbon-free, and sustainable energy, supporting a secure net-zero future.

INDIA SOLAR NEWS

Think Tank >

Inclusive Pathways For Clean Energy: IRENA's Toolkit On Participatory Planning

IRENA's toolkit on participatory long-term energy planning guides governments in inclusive clean energy transitions. Engaging diverse stakeholders—including prosumers, communities, civil society, and businesses—builds trust, gathers varied inputs, and aligns scenarios with political realities. Structured around knowledge gathering, co-creation, and dissemination, the toolkit offers tools like workshops, consultations, and interactive platforms. Case studies from 13 countries show tailored approaches, from Brazil's virtual debates to Canada's Energy Modelling Hub. Challenges include tokenistic engagement, limited feedback, and institutional constraints. Leveraging AI and digital tools can enhance transparency. Participatory planning fosters legitimacy, equity, and trust, accelerating effective, inclusive energy transitions.

IRENA Launches Toolkit to Strengthen Stakeholder Participation in National Energy Planning

IRENA's new toolkit, "Participatory Processes for Strategic Energy Planning," guides national planners in integrating stakeholder engagement into long-term energy strategies. Emphasizing inclusivity, transparency, and early involvement, it advocates continuous participation from planning through implementation to ensure social legitimacy, trust, and durable strategies. The toolkit highlights legal and institutional frameworks to embed feedback into decision-making and balance diverse interests. Moving away from top-down models, it equips planners to foster dialogue, consensus, and co-creation. By engaging communities, industry, and civil society, the approach strengthens accountability, equity, and acceptance, accelerating renewable energy transitions that are socially fair, politically stable, and sustainable.

Tech >

Pushing Photovoltaics Further: Quantum Dot Tech Arrives In Thin-Film Solar

UbiQD has signed a multi-year agreement with First Solar to supply fluorescent quantum dots for thin-film bifacial PV modules, marking the first high-volume solar application of QDs. The technology enhances bifacial efficiency and energy capture. Supported by $20 million Series B funding, UbiQD plans a large-scale New Mexico facility, advancing commercial quantum dot deployment in solar energy.

Grid-Forming Inverters Drive SUREVIVE's Innovation For Solar-Dominated Grids

Germany's Project SUREVIVE is testing grid-forming inverters and battery storage in real distribution grids to ensure voltage and frequency stability in solar-powered networks. Led by Westnetz and Fraunhofer ISE, the project validates 20 MW/55 MWh systems through lab pre-tests and simulations. Results will guide best practices for inverter-based grids, supporting Europe's transition to stable, renewable energy networks.

New Research Shows Star-Shaped Receivers Cut LCOH By 30% And Reduce CAPEX In CSP Plants

Researchers from Politecnico di Milano and QUT developed star-shaped solar receivers for CSP plants, achieving 30% lower Levelized Cost of Heat and up to 75% reduced CAPEX. The design enables double-sided irradiation, reduces thermal stress, extends lifespan, and improves energy capture by 5%. Using fewer tubes and cost-effective materials it enhances efficiency and makes CSP more economically competitive.

New Probabilistic Model From TU Delft Enhances Forecasting For Urban Residential Solar Fleets

TU Delft researchers developed a probabilistic framework to predict residential solar PV output in dense urban areas without sensitive installation data. Using the Sky View Factor, the model estimates shading and irradiance quickly and accurately, validated against real-world data. Privacy-preserving and scalable, it enables fleet-level forecasting, real-time grid planning, smart city energy management, and future integration with AI-based solar predictions.

RESEARCH STORY

Scaling Solar With Agri-PV And Floating PV: New Tech Pathways For Business Growth

India's solar journey has witnessed remarkable growth over the past decade, but to sustain momentum and achieve ambitious renewable energy targets, the sector must look beyond conventional ground-mounted projects. Two emerging technologies, agrivoltaics (Agri-PV) and floating solar (Floating PV), are creating new opportunities for business growth by addressing land constraints, improving energy yields, and promoting resource efficiency. These innovative models represent a pathway that combines technology advancement with social and environmental benefits.

Agri-PV offers a way to overcome the growing challenge of land availability for large solar projects. By integrating solar panels with agricultural activities, the same land can serve dual purposes—generating clean energy while supporting crop cultivation. The design ensures that panels are installed at an elevated height or with spacing that allows sunlight to reach the crops below. For India, where agriculture remains the backbone of the economy, this model aligns energy transition goals with farmer livelihoods. Studies have shown that certain crops benefit from partial shading, reducing water stress and improving yield stability. Agri-PV can also provide farmers with an additional income stream from leasing land or sharing project revenues, while developers benefit from access to land that may otherwise be unavailable for exclusive solar use. This creates a win-win model for rural communities and investors alike.

Floating solar, on the other hand, offers an innovative solution to India's growing water-energy nexus challenges. By installing solar panels on reservoirs, lakes, or dams, floating PV reduces the need for vast stretches of land and simultaneously helps conserve water. The panels act as a cover on water surfaces, reducing evaporation losses, which is particularly valuable in water-scarce regions. Additionally, the cooling effect of water enhances panel efficiency, leading to higher energy generation compared to ground-mounted systems. India has large untapped potential in reservoirs attached to hydropower dams and irrigation systems, offering an excellent opportunity to scale floating PV projects. States like Madhya Pradesh, Maharashtra, and Kerala have already initiated projects that are showcasing the viability of this approach.

For businesses, these two technologies represent a strategic growth pathway. Developers entering the Agri-PV segment can build partnerships with local farming communities, offering long-term lease arrangements that provide steady returns while ensuring social acceptance of projects. Financial institutions and policymakers are beginning to recognize the dual benefits of Agri-PV, and targeted incentives could unlock more investments. In the case of floating solar, project developers have the opportunity to collaborate with water utilities, irrigation bodies, and hydropower operators to design hybrid models that improve overall infrastructure utilization. Combining floating solar with existing hydro projects can enable better grid stability by blending variable solar output with hydropower flexibility. The success of scaling Agri-PV and floating PV in India will depend on supportive policies, innovative financing, and technological adaptations suited to local conditions. Standardization of design, affordable anchoring systems for floating PV, and crop-specific Agri-PV structures are crucial for lowering costs and ensuring reliability. Moreover, robust business models that emphasize community engagement, water management, and agricultural productivity will make these projects sustainable in the long run.

As India races towards its solar capacity targets, integrating Agri-PV and floating PV into mainstream development can expand the market beyond traditional land-based installations. These models not only unlock new business opportunities but also contribute to food security, water conservation, and rural development. The future of the Indian solar PV market will increasingly rely on such innovative pathways, where technology growth aligns seamlessly with environmental stewardship and community empowerment.

NARESH BALUJA

Chief Commercial Officer (Renewables and BESS)
ENGIE India

Leading India's Growth in Solar Storage and Renewables

KEY HIGHLIGHTS:

- *Delivering large-scale projects across states with reliable execution and agreements.*
- *Integrating BESS and hybrid solutions for round-the-clock power and stability.*
- *Training local workforce and implementing initiatives to build trust and impact.*

Q How is ENGIE positioning its leadership in India's fast-growing solar PV market?

ENGIE is setting the benchmark in India's solar PV market by combining scale with disciplined execution and secure offtake agreements. Our portfolio spans 2.4 GW across 23 projects in 7 states, including 1.1 GW operational capacity and 1.35 GW under construction, supported by over €1 billion in investments to date.

Our strength lies in delivering results in a complex market. We proactively manage risks related to permitting, grid connectivity, and compliance—leveraging decades of global expertise. By engaging early and consistently with DISCOMs, regulators, and local authorities, we align with policy frameworks and maintain project timelines. This approach proved resilient during the pandemic, enabling us to commission large-scale assets without compromising safety or deadlines.

We also differentiate through performance. Advanced digital forecasting and predictive O&M tools enhance yield and minimize curtailment. Our leadership in ESG builds trust: ENGIE India earned the Sustainable Energy Transition Label in December 2024, 80% of our workforce is locally hired, and over 600 solar technicians have been trained, strengthening capabilities on the ground.This integrated model—combining reliable capacity, strong counterparties, data-driven operations, and deep stakeholder engagement—positions ENGIE as a clear leader in India's renewable energy landscape.

Q What role will ENGIE play in shaping competitive solar capacity expansion to 7 GW by 2030?

ENGIE is driving the competitive scale-up of solar energy in India, with reliability and bankability at its core. We are targeting 7 GW of installed renewable capacity by 2030, with approximately 75% of new additions coming from solar, supported by a planned investment of around €3.5 billion.

Our approach is twofold:

Integrate Battery Energy Storage Systems (BESS) into future solar and hybrid projects to enhance dispatchability, improve grid stability, and support round-the-clock and hybrid procurement.

Create demand certainty and cost efficiency for buyers through our **Supply & Energy Management vertical,** offering Virtual Power Purchase Agreements (VPPAs), portfolio optimization, and monetization of green attributes such as Renewable Energy Certificates (RECs) and carbon credits.

We are expanding our corporate PPA offerings to enable commercial and industrial (C&I) consumers to transition to clean energy with predictable pricing and measurable decarbonization outcomes. In parallel, we emphasize standardized, lender-grade contracting and close collaboration with utilities, offtakers, and financiers to accelerate the adoption of solar-plus-storage solutions.By combining ambition with local execution—and diversifying across solar, wind, and global storage-integrated projects—ENGIE is helping India scale up renewable capacity while enhancing system reliability, affordability, and investor confidence.

Q How are you leading market growth through large-scale solar projects in Gujarat and other regions?

ENGIE's India journey spans three decades, with the last ten years focused on scaling renewables from our first 5 MW solar plant in Rajasthan (2014) to a 2.4 GW portfolio across 23 projects in 7 states. Gujarat is a core growth hub: our 400 MW GUVNL-II project, now under construction, is our largest in India and reflects our ability to deliver complex utility-scale assets at speed. We have built and operated marquee projects that create durable capacity and a strong execution template.

1. GUVNL-I (Raghnesda Solar Power Plant) - Resilience in Action

- The 200 MW Raghnesda Solar Power Project in Gujarat's Banaskantha district exemplifies ENGIE's ability to deliver under pressure. Commissioned in August 2021 amidst the COVID-19 pandemic, the project was completed in just 18 months with a zero-infection record, highlighting our uncompromising commitment to health, safety, and operational continuity.
- Developed by our wholly owned subsidiary, Electro Solaire Pvt. Ltd. (ESPL), the plant supplies approximately 546 GWh of clean energy annually, offsetting over 387,000 tons of CO_2 emissions. It operates under a 25-year PPA with Gujarat Urja Vikas Nigam Limited (GUVNL), and continues to set benchmarks for resilience-led project delivery.

2. Kadapa Solar Power Project - Scale with Precision

- Spanning 5,930 acres in Andhra Pradesh's Kadapa Ultra Mega Solar Park, this 250 MW project is one of India's largest commissioned projects till date. Developed by SolairePro Urja Pvt. Ltd. (SPUPL), it was commissioned in two phases between June 2019 and March 2020. The project uses advanced string inverters to enhance efficiency and system accessibility, and supplies power under a 25-year PPA with NTPC Limited.

3. Mirzapur Solar Plant - A Symbol of Indo-French Collaboration

- Jointly inaugurated by Prime Minister Narendra Modi and French President Emmanuel Macron, the 75 MW Mirzapur Solar Plant is a landmark in bilateral renewable cooperation. Spread across 385 acres in Dadar Kalan village, the plant uses over 318,000 solar panels to generate 190 million units of clean electricity annually. Commissioned in March 2018, it remains one of Uttar Pradesh's largest solar projects.

4. Bhadla Solar Project – Innovation in Harsh Environments

- Located in Rajasthan's high-irradiation Thar Desert, the 140 MW Bhadla Solar Project was the first in India to deploy water-free robotic cleaning systems. These autonomous robots, remotely controlled via a cloud-based platform, combat heavy dust accumulation from desert storms and are expected to save over 2 billion litres of water over the plant's 25-year lifecycle

It is this mix of scale, reliable long-term partnerships, and innovation in execution that anchors our leadership position. Looking ahead, we are integrating battery energy storage into upcoming solar and hybrid builds to enhance dispatchability and grid stability, strengthening the value of large-scale solar in Gujarat and beyond.

Q How is ENGIE creating market leadership through financing models and long-term partnerships?

At ENGIE, we see financing models as central to scaling India's renewable energy transition. Our focus is on building structures that make projects bankable, attractive to investors, and viable at scale. On the financing side, we explore blended mechanisms such as viability gap funding and long-term PPAs with storage components to bridge cost gaps and improve project feasibility. We also leverage our Green Bond Framework to raise capital dedicated to climate-aligned investments, while tapping into long-tenor funding from international banking partners. These approaches help reduce risk, lower the cost of capital, and accelerate renewable deployment.

Equally important are long-term partnerships. We work with corporate buyers to structure innovative Power Purchase Agreements that increasingly incorporate storage, enabling them to secure reliable clean power while reducing grid dependency. On the public side, we collaborate with SECI, NTPC, and state utilities to design viable, storage-backed renewable solutions aligned with national policy goals. Together, these financing models and partnerships form the foundation of our leadership in India's clean energy market, ensuring we can deliver both scale and reliability as the country advances toward its 500 GW renewable target.

Q How do you see ENGIE driving market leadership with innovations like storage, hybrids and floating solar?

At ENGIE, storage and hybrids are central to delivering reliable, cost-effective renewable power at scale. We are targeting 10 GW of battery capacity globally by 2030 and have already commissioned 5.2 GW. By integrating BESS with our solar and wind assets, we improve dispatchability, enable round-the-clock clean power, and strengthen grid stability. "ENGIE has scaled its U.S. Battery Energy Storage portfolio to 1.8 GW operational capacity across 24 projects as of September 2024, reinforcing grid reliability and enabling 24/7 clean power delivery in North America.

Our approach is technology-led and execution-focused:

- **AI and smart grid control:** We deploy AI-driven energy management to maximise utilisation and lower operating costs. Our battery optimisation platform manages 40+ systems using real-time data, advanced analytics, and machine learning to decide when to charge and discharge based on carbon impact, grid constraints, and battery life. This has improved fleet availability by 5–10 percent and enhanced economic returns. Advanced forecasting aligns production with customer consumption and market conditions, reducing total cost of ownership and improving decision-making.

- **Hybrid energy systems with storage:** As the energy landscape evolves, ENGIE is sharpening its focus on hybrid solutions and storage-backed projects that transform variable solar and wind into intelligent, dispatchable power — enhancing grid stability while improving the commercial viability of renewable assets.

- **Operational intelligence at scale:** Our Fleet Performance Diagnostic Centre provides real-time monitoring, performance analytics, and predictive maintenance across solar assets for higher uptime and data-driven decisions.

- **Diverse storage formats:** Drawing on global experience, we develop co-located and stand-alone storage that can reinject energy to the grid, demand-side batteries for industrial and residential users, and modular, scalable setups integrated with smart grids for real-time balancing and dispatch optimisation.

- **Efficiency in tough environments:** In remote or water-scarce regions we use robotic cleaning to maintain peak solar performance while conserving water.

To complement generation and storage, our Supply and Energy Management vertical offers VPPAs, portfolio optimisation, green attribute monetisation including RECs and carbon credits, and strategic advisory. This combination of BESS integration, digital optimisation, hybrid system design, and fit-for-purpose contracting positions ENGIE to scale dependable clean energy and support India's transition to a resilient 24/7 renewable ecosystem.

Q How are you leading market growth through large-scale solar projects in Gujarat and other regions?

ENGIE is committed to India for the long term, with a goal of building 7 GW of renewable capacity. Our credibility stems from consistent delivery, transparent performance data, and visible community impact.

In **Gujarat,** we've enhanced school infrastructure, provided access to safe drinking water, and built a new school shed benefiting over **400 students.** In **Tamil Nadu,** we empower women beekeepers through training and year-long mentoring—boosting both income and biodiversity.

Through our strategic partnership with the **National Skill Development Corporation (NSDC),** we've trained over **600 youth** across **Rajasthan** and **Andhra Pradesh,** equipping them with job-ready skills and connecting them directly to employment opportunities in the renewable energy sector. In **April 2024,** we hosted a **Job Fair and Felicitation Ceremony in Bikaner,** celebrating their achievements and facilitating direct engagement with leading industry recruiters. We complement these efforts with proactive policy engagement, strong offtaker partnerships, and local capability building. The result is a partner that not only delivers reliably today but also helps shape the energy market India needs for tomorrow.

RESEARCH STORY

Storage + Solar: Business Leadership In Driving Hybrid Technology Solutions For A Reliable Grid

Storage and solar are becoming the most important combination for the Indian energy sector, with hybrid technology solutions emerging as a strong pathway to achieve grid reliability. India has made rapid progress in scaling solar PV, but as penetration increases, the challenges of variability and intermittency are becoming more visible. The integration of energy storage, particularly battery systems, with solar plants is proving to be the most effective answer to these challenges. This hybrid approach not only ensures continuous and reliable power supply but also strengthens grid stability, a critical requirement for India's long-term renewable energy growth.

The Indian solar PV market is moving from capacity addition targets to building efficiency, resilience, and flexibility into the system. Large-scale solar projects are already being designed with integrated storage, and policymakers are encouraging developers to consider storage as part of project planning rather than an afterthought. The Ministry of Power and the Solar Energy Corporation of India have released tenders specifically focused on renewable plus storage projects, signaling the direction in which the market is heading. These projects can deliver round-the-clock renewable power, a critical milestone for reducing dependence on fossil fuels and achieving India's ambitious net-zero goals.

From a business leadership perspective, the transition toward hybrid technology is being driven by forward-looking companies that recognize the value of offering complete energy solutions rather than just standalone generation. Leaders in the Indian solar PV market are not only investing in advanced storage technologies but also developing business models that make hybrid projects commercially viable. The cost of battery storage is falling steadily, and with economies of scale, hybrid projects are becoming more competitive compared to conventional thermal generation. This is an important signal to industries and distribution companies looking for reliable clean power at affordable prices.

Hybrid technology solutions also open new opportunities for distributed energy. Rooftop solar combined with storage is beginning to appeal to commercial and industrial consumers who need uninterrupted power supply without relying on expensive diesel generators. By pairing solar PV with storage, businesses can optimize energy use, reduce peak demand charges, and maintain energy security even during grid disruptions. In rural areas, storage plus solar can accelerate electrification and provide reliable power for agriculture, education, and small-scale industries, creating a positive impact on local economies.

Grid operators also benefit from solar plus storage, as hybrid systems can help manage peak loads, stabilize frequency, and balance supply-demand fluctuations. This reduces the stress on transmission infrastructure and lowers the need for costly grid upgrades. As India continues to expand its renewable energy base, such flexibility will be vital for ensuring a smooth transition to a cleaner grid.

The leadership role of Indian companies, combined with strong government support, is shaping a new era of energy innovation. By focusing on hybrid solutions, India is building a model that not only addresses technical challenges but also creates long-term value for consumers and investors. The combination of storage and solar is no longer just a future possibility—it is becoming the backbone of a reliable, affordable, and sustainable energy system for the country.

EXPERT SPOTLIGHTS

SANJEEV JAIN

Chief Engineer (Retd.)
Chhattisgarh State Renewable Energy Development Agency (CREDA)

India's Solar PV Growth Pathway Towards Opportunities And Challenges

KEY HIGHLIGHTS:

- *India surpasses 100 GW solar capacity, driven by policy and investment.*
- *Emerging solar hubs include Maharashtra, Telangana, Uttar Pradesh, and Madhya Pradesh.*
- *Technological innovations and PPPs are fueling sustainable growth in the solar PV sector.*

Q How do you assess the growth trajectory of the Indian solar PV market, and what are the key factors driving this expansion?

India's solar PV market is undergoing an accelerating growth, surpassing 100 GW of installed capacity in early 2025, with significant future growth projected. This expansion is fueled by ambitious government targets, favourable policy frameworks, declining module costs, and an enhancement in cell efficiency. Key drivers also include increased energy demand, supportive financial incentives, the development of large-scale solar parks and rooftop solar, a growing domestic manufacturing base, and international investment.

Q Which regions or states in India do you see as emerging hubs for solar PV deployment in the next 3-5 years, and why?

Emerging hubs for solar PV deployment in the next 3-5 years include Maharashtra, Telangana, Andhra Pradesh, Uttar Pradesh, and Madhya Pradesh, driven by strong government policies, high solar irradiance, rapid industrialisation, and initiatives to integrate solar into agriculture and residential sectors.

While established leaders like Rajasthan and Gujarat will continue to grow, these states are poised for significant expansion due to their potential, policy support, and focus on diversified solar applications.

Q What challenges do developers and investors face in the Indian solar market, and how can these be addressed?

Indian developers and investors face challenges, including high capital costs, supply chain dependency on imported components, grid integration issues with unreliable infrastructure, and complex land acquisition processes.

To sustain growth, the sector needs strategic public-private partnerships, advancements in energy storage and smart grid technology, improved financing mechanisms, supportive policies that enforce Renewable Purchase Obligations (RPOs), and significant investment in developing a robust domestic manufacturing and skilled workforce.

Q How do you foresee policy reforms, such as rooftop solar and bidding, shaping market dynamics in India?

Policy reforms like rooftop solar initiatives and competitive bidding will shape India's market dynamics by accelerating decentralized power generation, enhancing grid stability through flexible procurement, driving down costs for renewable energy, and promoting overall market transparency and investor confidence. Rooftop solar will increase the share of distributed energy, improving DISCOMs' forecasting, while competitive bidding will attract investment and ensure cost-effective power procurement. Integrated approaches to rooftop solar and competitive bidding are instrumental in helping India achieve its target of 500 GW of renewable energy capacity by 2030 and contribute to its net-zero goals.

Q How are advancements in solar PV modules and storage impacting adoption and investment in India?

Technological advancements are significantly boosting solar energy adoption in India by improving efficiency and reducing costs for PV modules and Battery Energy Storage, making solar power more competitive with traditional energy sources. Innovations like high-efficiency cells and modules and integrated storage solutions enhance energy yield and grid reliability, attracting greater investment through government policies such as the PLI scheme and driving market growth for solar power.

Advanced technology like heterojunction, tandem cells, and bifacial panels is increasing the efficiency of solar modules, allowing for greater energy generation from the same area. This makes solar more viable for a wider range of applications and environments.

Breakthroughs in manufacturing and material efficiency, coupled with increased economies of scale, are driving down the cost of both solar panels and storage systems, making them more affordable and competitive against conventional energy.

Integrated storage systems are emerging, providing solutions for energy storage directly with the panels. This, along with advancements in grid integration, helps overcome the intermittent nature of solar power and improves grid stability, a key concern in India.

The combination of higher efficiency, lower costs, and improved reliability facilitates the widespread adoption of solar energy across residential, commercial, and large-scale projects, contributing to India's renewable energy targets.

Policies like the Production Linked Incentive (PLI) Scheme are designed to boost domestic manufacturing of high-efficiency solar modules, attracting significant investment and creating jobs within India's solar ecosystem.

The declining costs and improved performance of solar technology make it a more attractive investment opportunity. Successful bids for solar and storage projects are demonstrating levelized costs of electricity (LCOE) that are competitive with coal, further stimulating investment.

Investments are increasingly directed towards comprehensive, whole-system approaches that integrate PV generation with storage and advanced grid technologies, as highlighted by the push for storage targets to shift energy to non-solar hours.

Incentives and policies are driving substantial investment into establishing a domestic solar manufacturing capacity, moving India towards becoming a solar powerhouse and reducing reliance on imports.

Q What opportunities exist for private-public partnerships and investor participation in India's solar PV sector?

India's solar sector offers extensive Public-Private Partnership (PPP) opportunities through large-scale solar parks, while private investors can participate via equity and debt financing, green bond issuance, and through services like Engineering, Procurement, and Construction (EPC) and consultancy. Key drivers include government incentives, growing energy demand, and initiatives like the PM Surya Ghar Muft Bijli Yojana, creating opportunities for technology innovation, improved grid infrastructure, and the development of a sustainable domestic supply chain.

MS. RADHIKA CHOUDARY

Co-Founder & Director
Freyr Energy

Driving India's Clean Energy Future Through Innovation And Sustainable Sola

KEY HIGHLIGHTS:

- *Focus on technology-driven solar accessibility and customer-centric innovation.*
- *Expanding opportunities in Tier 2 and 3 cities with hybrid solutions.*
- *Strengthening supply chain resilience and promoting domestic manufacturing growth*

Q Freyr Energy has been at the forefront of solar innovation—how do you see this shaping India's clean energy future?

Solar innovation is critical to India achieving its 500 GW renewable energy target by 2030. At Freyr Energy, we're focused on making solar accessible and efficient through technology-driven solutions. Our approach combines instant financing, smart monitoring, predictive maintenance, and customer-centric design to accelerate adoption across residential, commercial, and industrial segments—ultimately contributing to India's energy independence and sustainability goals.

Q Recent policy shifts are changing the solar landscape—what do you think will matter most for long-term growth?

Policy consistency and financial incentives will be crucial for long-term growth. Streamlined net metering policies, GST rationalization, and robust implementation of PM Surya Ghar schemes can unlock residential solar potential even further. Additionally, clear frameworks for energy storage integration and grid stability will determine how effectively we scale distributed solar generation.

Q Supply chain issues remain a big challenge—how is Freyr Energy building resilience to manage them?

We're diversifying our supplier base and building strategic partnerships with domestic manufacturers as India's solar manufacturing ecosystem matures. We've also optimized inventory management and leveraged long-term procurement contracts. Investing in relationships with OEMs helps us balance quality, cost, and supply reliability.

Q India has vast untapped regions—where do you see the biggest opportunities for expanding solar adoption?

Tier 2 and Tier 3 cities present enormous potential, along with energy management and automation. Industrial clusters in states with high power tariffs—like Maharashtra, AP, TS—are prime markets. The draft open access policy in Telangana State remains largely untapped and represents a transformative opportunity.

Q With trends like storage, hybrid systems, and digitalization gaining traction, how is Freyr Energy positioning itself?

IoT-enabled monitoring has been integral to our approach from the start—we've embedded real-time performance tracking across all installations. Storage solutions are now central to our offerings, driven by grid stability challenges in rural India and declining battery costs. We're developing intelligent hybrid systems that seamlessly integrate solar with grid power, while leveraging data analytics to optimize design and enable predictive maintenance. This makes solar not just cleaner, but more reliable and user-friendly for every customer.

Q What should be the key priorities for India's solar market over the next five years?

Three priorities stand out: First, scaling domestic manufacturing to reduce import dependence. Second, accelerating energy storage deployment to address intermittency. Third, improving consumer financing options and awareness, especially in underserved markets. Building a skilled workforce for installation and maintenance will also be critical to sustain growth.

MALVIKA SAINI

Head Strategic Communications
Gentari, India

Powering India's Clean Energy Transition Through Renewables, Hydrogen, and Decarbonisation-as-a-Service

KEY HIGHLIGHTS:

- *Gentari integrates renewables, hydrogen, and green mobility, helping India in its decarbonisation and net-zero energy transition journey.*
- *Distributed C&I renewable energy and DaaS empower industries with resilience, cost predictability, and operational sustainability advantages.*
- *International collaboration accelerates India's clean energy growth, combining technology, capital, and local execution expertise effectively.*

Q How is Gentari positioning itself to play a leading role in India's clean energy transition across renewables, green hydrogen, and mobility?

India, as the world's third-largest energy consumer, holds a pivotal role in shaping the global clean energy transition: not just in renewable capacity addition, but also in becoming a global hub for scalable decarbonisation solutions that can be replicated across emerging markets.

Gentari is committed to enabling this journey by integrating solutions across Renewables, Hydrogen, and Green Mobility, solutions designed to address industrial demand at scale, strengthen grid resilience, and accelerate the shift towards net zero.

Our vision is for India to be the proving ground where innovation, infrastructure, and policy alignment converge, setting a benchmark for the Asia Pacific region and beyond.

Q What are the main opportunities and challenges for India to reach 500 GW of non-fossil energy by 2030?

The energy transition has already picked up pace - strong policy frameworks, rapidly declining RE costs, and a huge industrial base that can adopt large-scale clean solutions. Achieving 500 GW of built capacity may not be a challenge, but the real challenge lies in making it resilient by integrating battery storage and ensuring delivery to homes and industries through robust transmission infrastructure. Hybrid projects, FDRE/hybrid PPAs, storage and flexible load management create an opportunity to increase the share of renewables in actual consumption, not just installed capacity. There's also an opportunity for inclusive development: deploying projects that benefit local economies, use degraded lands, and create skilling and jobs in rural areas.

At present, the two biggest hurdles are temporal mismatch (intermittency vs demand) and system integration which requires large investments in storage (batteries, pumped storage), hybrid generation, transmission and smarter demand-side solutions. Policy and markets must evolve and make hybrid/FDRE contracts standard, simplify open access and GNA adoption across states, and continue transmission incentives to enable power flow from resource-rich to load-rich regions. Land, water and community consent are real constraints too; developers must embed socio-economic benefits to secure sustainable deployment. Finally, skilled manpower and faster permitting are essential so projects can be built and operated at scale.

Q How do you see India's green hydrogen market evolving in cost, demand, and export potential?

Green hydrogen costs will fall materially as electrolyser manufacturing scales, stack and system costs improve, and renewable power for electrolysis becomes cheaper and more dispatchable. Achieving significant cost reduction on green hydrogen will require continued RE scale-up, localising electrolyser supply chains, and policies that de-risk early investments (subsidies, transmission waivers, DEEP-offtake contracts). We expect meaningful cost declines over the next decade, driven by learning curves and larger project sizes.

Initial demand will come from hard-to-abate sectors, steel, refineries, cement, chemicals, fertilisers and long-haul transport where electrification is either impractical or ineffective. As prices fall and industrial offtake grows, hydrogen will move from niche pilot use to commercial substitutions for grey hydrogen and fossil feedstocks. We'll also see growth in hydrogen derivatives (green ammonia, methanol) for shipping and long-duration storage applications.

India can become both a large domestic market and an exporter of hydrogen derivatives, leveraging abundant solar and

wind resources and lower land costs. To realise export potential, projects must flexibly seek to adjust project configuration to meet the market specific low-carbon fuel standards (which currently are different across markets) while optimising costs, and address logistics (ammonia shipping, receiving terminals and where applicable, cracking solutions) and establish long term offtakes. Policy clarity, predictable incentives, and early partnerships with importing countries will accelerate India's emergence as a competitive green hydrogen supplier.

Q What role will distributed C&I renewable energy play in India's clean energy growth?

Distributed renewable energy has been, and will continue to be, a cornerstone of India's clean energy transformation. Unlike conventional utility-scale projects, distributed C&I solutions sit close to the load, enabling industries to decarbonise where it matters most — at the point of consumption. Over the last year, adoption has accelerated dramatically, with installations growing by more than 25% year-on-year, reflecting how commercial and industrial consumers are evolving from cautious adopters to strategic drivers of the renewable agenda.

At Gentari, we are serving over 400 C&I clients across sectors such as automotive, cement, FMCG, and data centres, we've witnessed how distributed systems can deliver more than clean power: they create resilience, operational control, and cost predictability. By integrating rooftop, captive, and hybrid systems with storage and digital energy management, industries can actively shape their energy consumption, manage demand peaks, and reduce dependency on the grid.

The true power of distributed C&I renewables lies in its ability to convert installed capacity into usable, reliable, and measurable clean energy. What was once a technology-driven experiment is now becoming a business imperative: industries no longer view clean energy as a peripheral sustainability goal but as a core operational advantage.

Q How do you view the role of international players in shaping India's renewable sector?

India's renewable energy transformation has always been a story of collaboration, where domestic execution meets global expertise. International players have brought tremendous value through capital, technology, and operational experience from mature markets. They bring the speed, scale, and financing depth required for a country of India's ambition, while introducing advanced technologies — from high-efficiency solar modules and digital asset management platforms to cutting-edge battery storage systems.

That said, India's transition will only succeed through an ecosystem approach. Local developers, EPCs, O&M specialists, and manufacturers are the backbone of execution — they understand ground realities, policies, and regional diversity. The best outcomes happen when international players co-create with India, not just invest in India — through technology transfer, local manufacturing, skill development, and joint ventures that strengthen our domestic value chain.

We've already seen this play out successfully in collaborations that have accelerated floating solar, hybrid, and battery energy storage projects, and introduced new financing structures that make renewables more bankable. At Gentari, we see such partnerships as a commitment with India a collaboration that fuses global best practices with local innovation.

If the next decade is about scaling up renewables from projects to integrated ecosystems — generation, storage, hydrogen, and green mobility then this blend of international capital and Indian capability will be key to reaching our 500 GW renewable target faster and more sustainably.

Q How are Indian industries responding to DaaS and integrated energy solutions, and what will drive faster adoption?

Indian industries are no longer looking at decarbonisation as a compliance exercise — they're viewing it as a strategic advantage and that shift in mindset has created the perfect space for Decarbonisation-as-a-Service (DaaS) to thrive.

At Gentari, we see DaaS as a catalyst for sustainability - a model that brings renewable energy, hydrogen, energy storage, and green mobility under one umbrella. It's not just about installing RE plants or EV chargers; it's about delivering decarbonisation outcomes that make businesses more competitive, resilient, and future-ready. For Indian industries, that means moving away from guesswork in investments towards predictable performance: power delivered, carbon avoided, and uptime guaranteed. Each solution is designed around the client's operational profile — their load, demand peaks, and sustainability targets — not around a generic roadmap or template.

Gentari's partnership with Ultratech Cement Limited exhibits such approach. Gentari partnered with UTCL to develop an RE portfolio tailored to its operational requirements and long-term decarbonisation objectives. The solutions combine flexibility, reliability, and regulatory alignment to support UTCL's energy transition journey. By aligning energy strategies with UTCL's evolving requirements, Gentari supports the company's efforts to lower emissions, strengthen efficiency, and build resilience. So far, Gentari's partnership with UltraTech Cement Limited has resulted in the successful implementation of 40 renewable energy projects across multiple states, demonstrating a tailored approach to meeting industrial energy needs. It aslo includes hybrid and firm power solutions designed to ensure operational reliability and efficiency.

Collaboration is going to be key for DaaS to thrive. It requires the industry and developers to work together throughout the entire decarbonisation journey - from target setting and roadmap creation, all the way through to solution implementation and results reporting. Beyond that, alignment is also crucial among developers, financiers, technology partners, and regulators to make long-term service models financially viable. The confidence to commit to 10 to 15-year service contracts grows only when technology reliability, credit mechanisms, and risk-sharing frameworks evolve together.
As trust, transparency, and service innovation deepen, DaaS will redefine how industries consume clean energy — not as infrastructure, but as an intelligent service that delivers decarbonisation on demand.

RESEARCH STORY

From Panels To Platforms: The Role Of AI And IoT In Transforming Solar Asset Management

The solar energy industry is moving beyond the installation of panels and into an era where digitalization, artificial intelligence (AI), and the Internet of Things (IoT) are redefining asset management. As solar capacity expands across utility, commercial, and residential segments, the complexity of managing thousands of distributed assets has created a demand for smarter, data-driven solutions. Traditional approaches of manual monitoring and periodic inspection are proving insufficient in handling large-scale portfolios, where downtime or inefficiencies can lead to significant revenue losses. Digital technologies are now enabling real-time monitoring, predictive maintenance, and performance optimization, making solar energy more reliable and financially attractive.

Digitalization in solar asset management begins with advanced data collection. IoT sensors embedded in panels, inverters, and meters provide granular data on energy generation, temperature, irradiance, and equipment health. These sensors act as the foundation of smart asset management by continuously transmitting performance metrics to centralized platforms. Once collected, AI-driven analytics play a critical role in interpreting this data. Machine learning algorithms detect deviations in performance, identify underperforming strings or modules, and predict potential equipment failures before they occur. This predictive capability reduces unscheduled maintenance and minimizes operational costs, while maximizing uptime and energy yield.

AI's role extends further into forecasting and decision-making. By analyzing historical weather data, consumption patterns, and system performance, AI can forecast generation and optimize dispatch strategies for solar plants integrated with storage. For investors and operators, AI-powered financial models enhance transparency by linking operational data directly with financial performance indicators. This integration provides actionable insights for improving returns on investment and meeting compliance requirements. Digital platforms also allow stakeholders, from asset owners to lenders, to access standardized reports and dashboards in real time, strengthening accountability and trust across the value chain.

The integration of IoT with digital platforms creates an ecosystem where solar assets can be managed remotely and at scale. For instance, virtual power plant (VPP) models aggregate distributed solar systems through IoT-enabled connectivity, allowing operators to treat decentralized assets as a single, flexible resource. Such platforms not only improve asset management but also support grid stability by responding to demand fluctuations in real time. This aligns with broader policy goals of integrating more renewables into the grid while maintaining reliability.

Another key advantage of digitalization lies in lifecycle management. Solar assets, designed for 20–25 years of operation, require consistent monitoring to ensure optimal performance throughout their lifespan. AI-enabled digital twins —virtual replicas of physical assets—are increasingly being used to simulate performance under different conditions and evaluate degradation trends. This allows asset managers to plan maintenance schedules strategically, extend asset lifespans, and manage repowering decisions more effectively.

The transformation also carries implications for workforce skills and industry practices. As solar companies adopt AI and IoT-driven asset management, the need for digital literacy and data analytics expertise within operations and maintenance (O&M) teams is growing. Companies are investing in training programs and partnerships to build capabilities in software-driven asset management, moving away from traditional manual methods. Moreover, cybersecurity emerges as a new frontier in solar O&M, as digital assets and data platforms must be safeguarded against potential threats.

In India, where solar capacity is projected to reach 500 GW by 2030, the shift from panels to digital platforms is becoming critical. With geographically dispersed projects and increasingly competitive tariffs, efficient asset management through digitalization is no longer optional but a necessity for ensuring profitability and long-term sustainability. Globally, too, investors are favoring projects that demonstrate strong digital asset management frameworks, viewing them as lower risk and more resilient.

The evolution of solar asset management through digitalization, AI, and IoT represents a structural shift in how the industry operates. What was once a field dominated by hardware efficiency is now defined by software intelligence. This convergence of technology and energy ensures that solar assets deliver maximum value, support grid integration, and enhance investor confidence. Ultimately, the transition from panels to platforms is not just about managing solar plants more effectively—it is about creating a smarter, more adaptive, and sustainable energy ecosystem.

NEXT-GEN LEADERSHIP

Grooming Future Leaders for India's Solar Industry – Role of mentorship, skills, and leadership training in the PV sector

Over the last decade we have seen the true evolution of India's solar journey. Streamlined political leadership, fixed targets, policies supporting growth at both national and regional level, and technological breakthroughs have taken India from a nascent solar power to one of the largest in the world. Gigawatts, modules, batteries, manufacturing etc. have become buzzwords, however a critical component overlooked and underdiscussed are the people. While enough recognition is there for leaders of yesterday and today, there is hardly any mention of leaders of tomorrow who will truly be the future of the sector.

The solar industry's growth is no longer a question of if and when, but rather how and who. Scaling the talent pipeline to keep pace with the technological and financial goals is an essential. Achieving the 500 GW of renewables capacity by 2030, will not only require highly skilled project managers, engineers and financiers, but also leaders who can stand out and deliver through their abilities to adapt, mentor and inspire in this ever-evolving sector.

The Leadership Gap

The gap lies with the fact that most new talent entering the solar sector comes with a very strong functional expertise such as in engineering, design and operations, without having been exposed to overall business strategy. The challenge intensifies as the sector today requires a leader to not only be good at business, but also in stakeholder management, especially at the policy front. Teams or individuals working in silos becomes a deterrent as organisations continue to scale amid shrunken timelines, making it imperative to groom leaders who can in tandem manage policy with profitability.

Passing the Torch

Leaders across industries both past and present have always stressed on the importance of mentorship and how it shaped their careers. In a sector like solar, where the learning curve is steep with rapid changes, structured mentorship can be a game changer. Current leaders across organisations need to take the ownership and responsibility to take under their wings the young professionals who show cross functional potential and guide them on decision making and resilience. Today's leaders have lived through a time where there was no visibility on how this sector would grow and have persevered to reach where they are. This real time experience cannot be taught through text books.

Skills for 2025 and beyond

Technical knowledge will continue to remain a vital skill set; however, India's solar sector leaders will need to be agile and versatile.

- **Cross Functional Excellence:** Leaders will need to be hands on and master technology, finance, and policy, not only domestic but also international.
- **People First approach:** As India aims for larger projects spread across both urban and rural, the ability to lead a large and diverse team, while also engaging with local communities becomes non-negotiable. Beyond Business know how, soft skills and morals such as empathy, and inclusivity need to be the natural order of things.
- **Innovate and be agile:** What were the go-to choice of panels, energy storage or monitoring yesterday will become a thing of the past in a few months' time. Leaders will not only be required to adapt, but also push for this innovation at every step.

Building Structured Pathways

While the onus of mentorship and development of future talent lies with the leaders of today, it cannot be done in isolation. Structured Leadership training and curated learning programs need to be created where individuals can learn multiple skills such as project finance, regulatory frameworks & environment, and cross functional leadership are the need of the hour. It can help catapult mid-level professionals onto the next phase of their professional journey. There needs to be healthy collaboration between industry associations, academic institutes and enterprises to bring theory into practice. Global programs like Germany's solar apprenticeship models have already shown how structured pathways can accelerate leadership development.

These programs also promote collaboration from an early stage as participants learn from each other's failures and wins.

Call to Action

India's solar ambitions of building capacities cannot function without building leaders. The investment needed in the sector needs to equally prioritise people and learning with technology. Technology without those who can harness it for true transformation and impact will not lead to success.

Young professionals need to see this time as an opportunity to seek guidance and prepare themselves to take the charge in the future. Solar plants of the future will not be built with only panels and batteries, but also with leaders who learnt how to turn ambition into action.

PIYUSH GOYAL
FOUNDER AND CEO
VOLKS ENERGIE

VISIONARY LEADERSHIP DRIVING

INDIA'S SOLAR GROWTH

Introduction

India's renewable energy transition stands as one of the most ambitious clean energy programs in the world. The government's target of achieving 500 GW of non-fossil fuel capacity by 2030 has set a decisive course for the nation's power sector. This goal is not merely aspirational—it represents a clear policy roadmap backed by leadership commitment, institutional reforms, and strategic investments aimed at transforming the country's energy landscape.

At the heart of this journey lies the rise of solar power as the most promising pillar of India's renewable energy expansion. From national-level planning to execution on the ground, visionary leadership has been instrumental in aligning policy, finance, infrastructure, and technology toward one unified mission: a cleaner, energy-secure India.

India's Progress Toward the 500 GW Milestone

India has emerged as a global leader in renewable energy deployment. As of September 2025, the country's cumulative solar power capacity reached approximately 127.33 GW, reflecting consistent growth across utility-scale, rooftop, and hybrid segments. Renewable energy sources collectively now account for more than 43% of India's total installed power capacity, signalling a decisive shift away from fossil fuels.

In the first half of fiscal year 2025–26 alone, the country added over 20 GW of new solar capacity, marking one of the strongest growth phases since the inception of the National Solar Mission. This momentum reflects how policy consistency and executive monitoring are ensuring timely project execution and effective delivery on renewable targets.

Policy Clarity and Institutional Alignment

Leadership vision has played a defining role in transforming India's renewable energy sector. Setting a clear national target of 500 GW of non-fossil capacity by 2030 created both accountability and a shared purpose across ministries, state utilities, and investors.

To translate this vision into action, leadership has focused on structural reforms; streamlining land approvals, simplifying contract mechanisms, and digitising clearance processes. Annual and state-wise capacity addition trajectories have been defined, allowing better planning for transmission, grid upgrades, and evacuation infrastructure.

Predictability in policy has also strengthened investor confidence. Transparent tendering systems, standardised contracts, and regular auction schedules have reduced uncertainty and helped developers plan capital expenditure efficiently.

Building the Pipeline and Expanding the Grid

Reaching the 2030 target demands not just policy intent but a strong, executable project pipeline. As per government data, hundreds of gigawatts of solar projects are currently in various stages of development, ensuring a steady flow of capacity additions over the coming years.

Equally important is the focus on grid infrastructure. Integrating high levels of variable solar energy requires a robust and flexible transmission network. Visionary leadership has emphasised proactive transmission planning through multi-year investment frameworks and the creation of new green corridors that enable interstate power flow.

These initiatives are reducing curtailment, ensuring balanced power distribution, and paving the way for hybrid and storage-linked projects that can deliver consistent power even during non-solar hours.

Strengthening Domestic Manufacturing and Supply Chains

A cornerstone of India's solar leadership lies in its emphasis on domestic manufacturing and self-reliance. Recognising the risks of import dependence, national leadership has introduced policies that encourage local production of solar modules, cells, and ancillary components.

The development of a domestic manufacturing ecosystem is not just an industrial policy decision; it is a strategic necessity. It stabilises project costs, creates employment opportunities, and enhances supply chain resilience. With increasing global competition for solar components, these efforts are helping India secure its renewable growth on firm ground.

Financing and Risk Mitigation Frameworks

Achieving 500 GW of renewable energy requires an estimated investment exceeding USD 200 billion by 2030. Recognising this, leadership has focused on creating a stable financial ecosystem to attract both domestic and international capital.

Mechanisms such as viability gap funding, green bonds, and sovereign guarantees for renewable projects have reduced financing risks and improved project bankability. The establishment of specialised institutions and green finance platforms has further enabled access to low-cost, long-term capital.

By addressing issues such as payment security, contract enforcement, and land acquisition delays, leadership has helped create an environment where investors can participate with greater confidence and predictability.

Grid Modernisation, Storage, and Technology Integration

With solar becoming the dominant contributor to new capacity, technological innovation and grid modernisation have become central priorities. Advanced digital tools, predictive analytics, and energy storage solutions are being integrated into the power ecosystem to handle solar variability.

Policy leadership has encouraged the development of hybrid renewable projects, battery storage systems, and smart grid technologies. These advancements help ensure grid stability, reduce curtailment, and enhance the reliability of renewable power.

Furthermore, initiatives to promote distributed energy systems and time-of-day tariff structures are improving grid flexibility and encouraging consumer participation in the clean energy transition.

Empowering States and Human Capital Development

While national policy sets the direction, state-level leadership ensures effective implementation. Many states are now aligning their renewable energy roadmaps with the national 2030 vision, supported by incentives for local generation and investments in solar parks.

Parallelly, leadership focus on skill development and workforce training is building a foundation of technical expertise across the solar value chain. Skill councils and training programs are preparing thousands of technicians, engineers, and project managers capable of sustaining India's expanding solar ecosystem.

By linking clean energy development with employment generation and regional growth, leadership is ensuring that the renewable energy transition delivers inclusive socioeconomic benefits.

Global Context and India's Strategic Position

Globally, solar power is leading the clean energy transformation. According to the International Energy Agency (IEA), solar PV is expected to account for more than 60% of new renewable capacity additions worldwide by 2030. India's proactive stance, driven by visionary policy leadership, positions it as a key contributor to this global shift.

By maintaining a balance between energy security, sustainability, and affordability, India is demonstrating that large-scale renewable transitions can be both economically viable and socially inclusive.

Conclusion

India's march toward the 500 GW renewable energy target reflects how visionary leadership can turn policy intent into actionable progress. Through consistent focus on clarity, coordination, and capacity building, leaders have transformed the renewable landscape into one of the world's fastest-growing clean energy markets.

From setting long-term targets to ensuring near-term execution, leadership has guided every stage of the transformation, policy design, project implementation, financing, and human capital development. As solar energy continues to anchor India's energy future, the nation's experience stands as a powerful example of how leadership, vision, and strategy can drive a sustainable and resilient transition to a cleaner tomorrow.

PRATIK MANDVIA

SOLAR BUSINESS HEAD
MUFIN GREEN FINANCE

RESEARCH STORY

Smart Manufacturing: How Indian Leaders Are Driving Automation In Solar PV Production

Smart manufacturing is becoming a cornerstone of India's solar PV industry, as leaders increasingly adopt automation and robotics to enhance efficiency, reduce costs, and maintain global competitiveness. The Indian solar sector, which is rapidly scaling to meet the country's renewable energy targets, is under constant pressure to improve productivity and quality while reducing dependence on imports. With the government's emphasis on domestic manufacturing through programs such as Production Linked Incentive (PLI) schemes and growing demand for solar installations, companies are turning toward smarter factories that integrate advanced technologies into their operations.

Automation in solar PV production is not limited to assembly lines but spans across multiple stages, including wafer cutting, cell processing, module assembly, quality inspection, and packaging. By introducing robotics in these stages, manufacturers are able to reduce human error, ensure precision, and improve consistency in production. For instance, robotic arms are widely deployed in solar cell tabbing, stringing, and lamination processes, which require accuracy at micron levels. The adoption of artificial intelligence and machine learning is also enabling predictive maintenance, defect detection, and real-time monitoring of plant operations. This not only boosts yield but also minimizes downtime, directly contributing to cost savings and better resource utilization.

Indian leaders in the solar PV space are increasingly recognizing that competitiveness depends on aligning with Industry 4.0 principles. Companies are investing in smart equipment that integrates sensors, Internet of Things (IoT) platforms, and cloud-based data analytics. Such integration allows seamless tracking of material flows, energy consumption, and production efficiency across facilities. Several manufacturers are adopting digital twins of their factories to simulate production processes and identify bottlenecks before actual implementation, thereby improving scalability and operational agility.

One of the main drivers behind this technological shift is the need to meet international quality standards. As Indian solar PV modules are increasingly exported to global markets, manufacturers must ensure compliance with strict reliability and performance requirements. Automated testing stations, vision-based quality control systems, and robotics-based material handling are helping companies achieve higher precision and uniformity. This is also vital in building credibility with global buyers, ensuring that Indian products can compete against established players from other manufacturing hubs.

At the same time, workforce transformation is becoming a key focus area. Smart manufacturing does not eliminate human involvement but shifts the role of workers from repetitive manual tasks to more skilled functions such as managing automated lines, analyzing production data, and troubleshooting high-tech equipment. Indian companies are working closely with skill development councils and training institutions to build a talent pipeline that can operate and maintain robotics-enabled manufacturing facilities. This focus on upskilling ensures that automation complements rather than displaces the workforce, aligning with India's broader socio-economic goals.

Policy support is playing a critical role in accelerating this trend. With the government promoting domestic manufacturing of solar PV through financial incentives, import duties on certain components, and infrastructure support in solar parks, there is a growing incentive for companies to upgrade to smart production systems. These measures are encouraging long-term investments in technology, ensuring that India is not only self-reliant but also an exporter of high-quality solar PV products.

As the solar PV industry matures, Indian leaders are proving that smart manufacturing is not just about technology adoption but also about building resilience and sustainability into the sector. Automation and robotics are helping create future-ready factories that are more competitive, efficient, and aligned with India's vision of becoming a global hub for renewable energy manufacturing. This transformation reflects a decisive step toward shaping the next phase of the solar industry, where innovation and technology will drive both business growth and the nation's clean energy ambitions.

LIGHTING THE WAY

Cultivating Leaders for India's Solar Growth

Witnessing a sunrise in a solar field feels different when you've been in the solar energy industry long enough to remember when these projects were sketches on a whiteboard. That perspective follows me on every site visit, where I meet young engineers brimming with ideas and veterans carrying decades of know-how. Somewhere between those two groups lies India's energy future, and it will move forward only as well as we unite them.

Today, the technology is advancing at a blistering pace. India is racing toward its 500-gigawatt clean-energy goal, with solar already carrying a major share about 123 GW of the installed capacity. But it's not just about megawatts or panel efficiency. What really matters is nurturing leaders who can navigate shifting policies, unpredictable supply chains, and global competition, and still foster innovation at home.

Mentorship, sharp skills, and structured leadership training will shape a generation ready to guide this industry's next phase. With the right focus on people as well as projects, India can grow talent at the same pace that it expands capacity, ensuring the progress we build today lasts for decades.

Shaping Leaders Who Can Steer Through Change

India's solar capacity has grown at an extraordinary pace, and the opportunity ahead is even greater. Sustaining this momentum means nurturing the next generation of leadership with the foresight to gauge long-term shifts in policy, technology, and markets and the agility to act when conditions evolve. The leaders rising now can design financing models that stay resilient through market swings, pair advanced storage with ageing grids, and draw talent from every corner of society. Expanding the presence of women in technical and leadership roles and encouraging ideas rooted in India will keep the country's solar momentum ascent strong as global competition accelerates.

Leveraging Mentorship as a Force Multiplier

Ask anyone who has spent a few years in solar, and they can usually name someone who shaped their journey. Turning that guidance into a structured practice can transform the industry. When experienced project heads work with young engineers, or policy veterans share how they handled difficult situations, what gets passed on is technical know-how combined with composure. That confidence is what helps professionals make the right decisions when the pressure is on.

Building Skills Beyond the Basics

Technical depth will always matter, but the future leaders need a broader set of capabilities. Understanding digital monitoring, project-finance analytics, and energy-storage integration is important. Leaders must also be able to think strategically, engage with diverse stakeholders, and work across different parts of the industry. Recognizing this need, some companies and industry bodies have begun blending hands-on apprenticeships with training in policy, strategy, and market dynamics. Expanding these programs beyond major cities will be key to identifying a vast pool of talent across smaller towns and emerging regions.

Making Leadership Everyone's Responsibility

Building the next generation of solar leaders must be perceived as a shared opportunity. Companies can create vibrant mentorship programs and foster a culture of continuous learning. Universities and training institutes have the chance to design courses that evolve with technology. Policymakers can encourage initiatives that open data and support leadership programs across the sector. Together, these efforts will shape a strong, capable, and future-ready leadership pipeline for India's solar industry.

Looking Ahead

The future of India's solar industry will be shaped by people who lead it. When experienced hands guide fresh talent, when skills meet curiosity, and when leaders are ready to make bold decisions, the rest that is, financing, technology, and policy, aligns well. The work we do today to nurture, train, and mentor the next generation will determine not just whether India meets its clean-energy goals, but how it sets the standard for renewable leadership globally. The opportunity is here, and there has never been a more exciting time to step up and make a difference.

ATEESH SAMANT
COO
OYSTER RENEWABLES

RESEARCH STORY

Inverter Intelligence: Why Power Electronics Defines The Next Leap In Solar Efficiency

The Indian solar industry has entered a phase where efficiency and reliability are no longer optional but central to success. As solar installations expand from rooftops to vast utility-scale projects, the role of power electronics, especially inverters, has become more critical than ever. Inverters are not just a link between solar modules and the grid; they are the brains of a solar project, dictating how energy is harvested, managed, and delivered. With India targeting ambitious renewable energy capacity, the evolution of inverter intelligence is set to define the next leap in solar efficiency.

Inverters today are not limited to basic conversion of direct current into alternating current. They are integrated with advanced control systems, digital platforms, and real-time monitoring tools that optimize the output of every panel. Features like maximum power point tracking (MPPT) ensure that even under variable conditions such as shading, dust, or cloud cover, the system extracts the highest possible efficiency. With the rise of bifacial modules, floating solar, and hybrid plants, this intelligence becomes even more important to stabilize output and balance generation with grid requirements.

Grid integration is another area where inverter intelligence is transforming the sector. India's grid is undergoing rapid modernization, but remains vulnerable to issues of intermittency and imbalance caused by large-scale renewable penetration. Smart inverters with reactive power management, voltage and frequency control, and fault ride-through capabilities act as stabilizers, ensuring grid harmony while supporting renewable expansion. This also reduces the burden on transmission infrastructure and allows smoother scaling of distributed energy resources.

In the context of hybrid power plants that combine solar with storage or wind, intelligent inverters play a central role in coordinating multiple sources. They allow seamless switching between solar power, battery support, or grid supply depending on demand and availability. For developers and investors, this means higher plant utilization factors, predictable returns, and a more bankable project. For consumers, it translates into a steady power supply and reduced reliance on fossil fuel-based peaking plants.

Digitalization further extends the leadership role of inverters. Remote monitoring platforms connected to inverters provide operators with predictive insights using artificial intelligence and machine learning. These insights help in forecasting performance, identifying potential failures before they occur, and optimizing maintenance schedules. The shift from reactive to predictive maintenance reduces downtime, lowers operating costs, and ensures long-term plant performance. In India, where projects are spread across diverse geographies with different environmental challenges, this layer of intelligence becomes a strong competitive advantage.

As module efficiencies plateau, much of the next leap in solar performance will come from smarter power electronics. Indian manufacturers and global leaders are already investing in localized R&D to tailor inverter solutions to India's specific grid codes, climatic conditions, and cost-sensitive markets. The push for domestic manufacturing under schemes like Production Linked Incentives also emphasizes inverters, recognizing their strategic role in the energy ecosystem.

The leadership of power electronics will not only define how efficiently India harnesses solar power but also how resilient and intelligent its energy future becomes. Inverter intelligence is no longer a supporting feature—it is the foundation of solar efficiency and the key to unlocking the next stage of India's renewable journey.

RESEARCH STORY

Leadership In Innovation: How Advanced Cell Technologies (Topcon, HJT, Perovskite) Are Shaping India's Solar Future

India's solar industry is entering a new phase of technological evolution as advanced cell technologies are beginning to define the pace and scale of growth. While conventional mono PERC modules have powered the rapid expansion of solar in the last decade, the limitations in efficiency are now pushing the industry toward more advanced solutions such as TOPCon, heterojunction (HJT), and perovskite solar cells. These technologies are not just incremental upgrades but represent a leap in performance that will determine how India meets its renewable energy targets.

TOPCon, or Tunnel Oxide Passivated Contact technology, has already started gaining momentum in India's manufacturing ecosystem. With efficiency levels crossing 24 percent in commercial production, TOPCon offers a clear path for manufacturers looking to upgrade from PERC without massive disruptions in infrastructure. Several Indian players have already announced plans to establish large-scale TOPCon lines under the government's Production-Linked Incentive (PLI) scheme. The advantage lies in its compatibility with existing PERC production lines, making it a cost-effective step toward higher efficiency modules. As the demand for rooftop and utility-scale projects grows, TOPCon is becoming the natural choice for domestic manufacturers seeking global competitiveness.

Heterojunction technology, or HJT, is also gaining attention, though it comes with higher capital investment requirements. HJT combines crystalline silicon with thin-film layers, delivering efficiencies beyond 25 percent and offering excellent temperature coefficients, which is particularly important for India's hot climate zones. The performance advantage in terms of lower degradation rates and bifacial design makes HJT modules attractive for high-performance solar plants. Indian companies exploring HJT are betting on its long-term value, even if the initial costs are steep. Over time, as equipment prices decline and manufacturing expertise grows, HJT could become a dominant technology in premium solar projects.

Perovskite solar cells represent the frontier of solar research and promise to revolutionize module production with their potential to achieve efficiencies above 30 percent. While still

at the laboratory and pilot stage, perovskites have captured significant global interest due to their low material cost, ease of processing, and compatibility in tandem structures with silicon. For India, the adoption of perovskite technology could align well with its research-driven initiatives and growing ecosystem of start-ups in clean energy. The challenge lies in scaling production while addressing stability and durability issues. If these are overcome, India could play a pioneering role in commercializing perovskite-based solar technologies, giving it an edge in global supply chains.

The leadership in innovation for India's solar sector will depend on how well the industry balances short-term adoption with long-term research. TOPCon offers an immediate solution for scaling efficiency, HJT provides a premium option for performance-driven installations, and perovskite represents the future of ultra-high efficiency at low cost. Together, these technologies can reshape India's solar journey, helping it achieve ambitious targets of 500 GW renewable energy capacity by 2030. The path forward will require not only investment in manufacturing but also strong support for R&D, technology partnerships, and policy frameworks that encourage innovation. India's ability to lead in advanced solar cell technologies will ultimately define its role in the global clean energy transition.

MARKET TRENDS

Solar Leasing and Shared Solar Models on the Rise

The global energy sector is undergoing a major transformation, with solar power at the heart of this transition. While the falling costs of solar panels and technological advancements have accelerated adoption, financing models such as **solar leasing** and **shared solar projects** are proving equally vital in expanding access to clean energy. These models are breaking financial barriers, enabling households, businesses, and communities to participate in the renewable energy movement without the burden of high upfront costs

Breaking Down the Cost Barrier

The capital-intensive nature of solar installations has historically been a roadblock. While costs have declined by more than **80% over the past decade,** affordability remains a concern for many. Solar leasing directly addresses this challenge. Instead of purchasing panels outright, consumers pay a fixed monthly fee for the use of the system or for the power generated. This model shifts the financial responsibility for equipment purchase, installation, and maintenance to the developer, while the consumer benefits from predictable and often lower energy costs.

Power Purchase Agreements and Shared Solar Models

Alongside leasing, **Power Purchase Agreements** (**PPAs**) are gaining ground. In a PPA, customers commit to buying solar-generated electricity at a pre-agreed rate, typically lower than grid tariffs, for a fixed term. According to the International Renewable Energy Agency (IRENA), PPAs accounted for more than **50 GW of renewable energy capacity additions globally in 2023,** with solar contributing a significant share.

Shared solar, also known as **community solar,** is another fast-growing model. It allows multiple users—often renters, apartment dwellers, or small businesses who cannot install rooftop solar—to subscribe to a portion of a larger solar project. Globally, similar models are expanding in Europe, Asia, and Africa, making solar accessible to populations excluded from traditional ownership models.

Commercial and Industrial Adoption

The commercial and industrial (C&I) sector is one of the largest adopters of solar leasing and PPAs. Rising electricity prices and growing regulatory pressures around emissions reduction are pushing enterprises to explore renewable energy solutions. According to BloombergNEF, corporate renewable energy procurement reached **46 GW in 2023,** with solar projects forming the majority. Leasing models allow organizations to reduce operational costs while aligning with sustainability targets, without locking large amounts of capital into infrastructure.

Regional Momentum

The momentum behind solar leasing is evident across regions:

Europe: Community solar projects are proliferating, particularly in countries with high urban density, where rooftop installations are limited.

Asia-Pacific: Emerging economies such as India are adopting "solar-as-a-service" models to expand energy access, while Southeast Asia is witnessing leasing programs bundled with energy storage.

Africa: Pay-as-you-go solar leasing is empowering rural households, with millions of micro-leases issued for decentralized solar solutions.

Investment and Growth Outlook

The attractiveness of leasing and shared solar is also reflected in investor confidence. Renewable energy financing through leasing models is forecast to grow at a **compound annual growth rate** (**CAGR**) **of 12-15% between 2024 and 2030**, according to industry research. Long-term revenue visibility and stable cash flows make solar leasing portfolios appealing to institutional investors, including pension and infrastructure funds. Moreover, the integration of **energy storage and electric mobility** is expected to further strengthen this market. By 2030, the global shared solar capacity could exceed **30 GW,** while solar leasing is projected to serve tens of millions of households worldwide.

Conclusion

The rise of solar leasing and shared solar models represents a critical step toward democratizing renewable energy. By removing financial and logistical barriers, these models enable broader participation across residential, commercial, and community segments. With supportive policies, investor interest, and continued cost declines, solar leasing and shared solar are not just financing innovations—they are catalysts accelerating the world's transition to a sustainable, inclusive energy future.

SHREYAS GOWDA
SENIOR VP SALES & OPERATIONS
OORJAN CLEANTECH

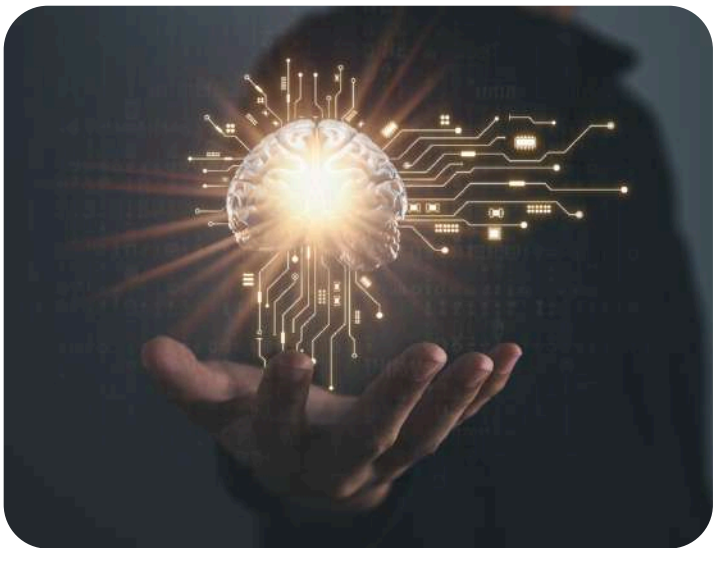
RESEARCH STORY

AI, Digital Twins, And Smart Grids: How Technology Leadership Is Reshaping Renewable Business Models

The renewable energy sector is no longer just about generating clean power; it is increasingly about how technology transforms business strategies, operational efficiency, and long-term competitiveness. Emerging tools such as Artificial Intelligence (AI), digital twins, and smart grids are reshaping how companies design, manage, and monetize renewable projects. For business leaders, adopting these technologies is becoming a strategic imperative rather than a futuristic choice.

AI has become a powerful enabler of predictive intelligence in renewables. From forecasting solar and wind generation with higher accuracy to optimizing battery storage dispatch, AI helps businesses manage intermittency more effectively. Energy producers are now moving away from static generation models to dynamic, data-driven strategies that balance supply and demand in real time. This reduces curtailment, enhances profitability, and improves grid integration. AI-enabled solutions also cut down on operational costs by predicting equipment failures and reducing downtime. The combination of cost optimization and better asset reliability allows renewable companies to offer more competitive pricing in power purchase agreements.

Digital twins are another game-changer in renewable business models. By creating virtual replicas of solar farms, wind turbines, or even entire grid systems, companies can simulate performance, detect inefficiencies, and plan upgrades without physical trials. These models allow executives to make investment decisions with greater confidence, as risks can be analyzed in a controlled environment before capital is deployed. Moreover, digital twins foster cross-functional collaboration, enabling engineers, financiers, and operators to work on the same virtual model. This integration not only improves efficiency but also shortens project development cycles. For leaders, digital twins provide a critical link between technical operations and strategic financial planning.



Smart grids represent the backbone of future-ready renewable business models. Traditional grids were designed for one-way electricity flows, but the rise of distributed generation requires a system that is flexible, intelligent, and adaptive. Smart grids leverage sensors, IoT devices, and advanced data analytics to manage two-way flows between utilities and consumers. This means renewable companies can participate in new revenue streams such as peer-to-peer energy trading, demand response programs, and dynamic pricing models. For consumers, smart grids provide transparency and control, making clean energy not only sustainable but also more participatory. Business leaders are realizing that the smart grid is not just infrastructure but a platform for innovation and new market opportunities.

What ties AI, digital twins, and smart grids together is leadership. Technology by itself does not create transformation; it is the vision of leaders who align digital tools with long-term strategies that brings real change. Companies that actively invest in digitalization are not only improving margins but are also setting new industry standards. They are moving beyond traditional revenue models based solely on generation to integrated approaches that combine technology services, data-driven insights, and customer engagement.

As renewable energy enters its next growth phase, leadership in technology adoption will define winners and laggards. Business models will continue to evolve around digital integration, creating an ecosystem where clean energy is smarter, more reliable, and financially sustainable. For leaders in the renewable sector, embracing AI, digital twins, and smart grids is no longer optional—it is the foundation of future competitiveness.

UTILITY-SCALE SOLAR v. DISTRIBUTED SOLAR IN INDIA:

WHERE SHOULD LEADERS FOCUS?

The growth of solar power in India's energy mix over the past decade has been remarkable. From a base of 2.84 GW in 2014, the country has now surpassed 100 GW of installed solar capacity (accounting for 47% of the country's total installed renewable capacity). While, wind started off as the preferred renewable source, solar took over to become the favourite fairly soon. Currently, solar power is at the centre of India's climate strategy and its being looked at as the front runner to contribute to our aggressive clean energy targets of 500 GW of non-fossil capacity by 2030.

One of the most prominent initial government initiatives to promote solar power in the country is Jawaharlal Nehru National Solar Mission (**"JNNSM"**). JNNSM realizing the importance, early on, of both grid connected solar plants and off-grid solar plants, contemplated the development of solar power through both these models.

Unfortunately, the distributed solar had a slow start; perhaps, due to the initial focus being on utility scale projects. The utility scale projects have been more attractive thus far due to their sheer scale (and economies of scale) and the role these could play in getting to our envisaged targets. And, thus the government policy initiatives (such as, waiver of inter-state transmission system charges, solar park policies, etc.) have been centred around these projects to promote their development and growth.

As of July 2025, our total solar capacity was at 119.02 GW out of which only 5.09 GW is from the off-grid solar installations and about 19.88 GW comes from grid-connected rooftop systems. Over the last couple of years distributed solar is gaining traction; mainly due to the central schemes issued by the Ministry of New and Renewable Energy, Government of India such as the PM Surya Ghar: Muft Bijli Yojana (**"PMSG Yojna"**) and PM Kisan Urja Suraksha Evam Utthaan Mahabhiyan (**"PM-KUSUM"**).

The PMSG Yojna targets 10 million rooftop installations by 2027, and offers subsidies, collateral-free loans and a national portal for applications. The PM-KUSUM supports decentralised solar plants (0.5 - 2 MW), standalone solar pumps and grid-connected pump solarisation, with an overall target of 30.8 GW by 2026. The subsidies offered are expected to bring down the per-unit generation costs (owing to smaller system sizes and higher installation overheads) which should help with greater penetration of distributed energy.

The distributed solar segment also now seems to be benefitting from the recalibration of the regulatory framework over the past few years. For example, the Electricity (Rights of Consumers) Rules,

2020 and Green Energy Open Access Rules, 2022 aim to streamline the policies across different States for developing rooftop or on-site solar power plants either grid-connected or off the grid.

Ideally, both, utility-scale and distributed solar should be advanced in tandem through different strategies. However, considering distributed solar has not been in the focus thus far and also since we now have a strong base portfolio of utility scale solar power plants, it may be advisable to focus on distributed solar projects in the short term. As there is a huge potential in this area waiting to be tapped. A number of government, commercial and residential buildings across different States are available which may be utilized for setting up small scale on-site solar power plants to serve their power needs and reducing reliance on expensive grid power.

Two biggest issues faced in the development of solar power plants is land availability and constraint in transmission infrastructure. Importantly, both these issues are not prevalent in distributed solar projects. Thus, providing another reason to shift the focus now to distributed solar.

In the medium to long term, a balanced approach between these two options would be required to ensure that we develop the capacity required for achieving India's 2030 renewable energy targets while increasing the solar penetration in not only residential and commercial space but also the rural and remote areas.

PALLAVI

PARTNER, PHOENIX LEGAL

Technical Progress and Application Status of String Inverters

Solis C&I Energy Storage Inverter with 4-in-1 Functionality

Introduction

As countries worldwide accelerate their push toward "dual-carbon" goals, photovoltaics (PV) are taking center stage in the global energy transition. In 2024 alone, around 530 GW of new PV capacity was added worldwide, with China contributing 277.6 GW — a 28.3% year-on-year increase.

At the heart of every PV system lies the inverter, the device that converts solar power into usable electricity. Inverters are generally divided into two categories: centralized and string. Over the past decade, string inverters have emerged as the mainstream choice, offering flexibility, adaptability, and strong potential to reduce both upfront investment and the levelized cost of energy (LCOE). By 2024, string inverters accounted for roughly 80% of global shipments, far ahead of centralized units at just 20%.

As deployment expands across residential rooftops, commercial and industrial systems, and large-scale ground plants, string inverters are evolving at an unprecedented pace. This article reviews the key technology trends and application developments shaping the market as we move into 2025.

The Core Driver: Lower Costs, Higher Efficiency

The demand for cheaper, more efficient PV systems continues to push string inverter technology forward. Three trends stand out:

- **High Voltage and High Power**

  Mainstream string inverters have transitioned from 1,100 V to 1,500 V DC input platforms, cutting current, raising conversion efficiency, and reducing costs. The next step is 2,000 V and beyond. Some manufacturers are already rolling out solutions in the 2,000 V / 400 kW+ range, driving down balance-of-system (BOS) costs even further.

  Alongside voltage gains, power density is rising. By 2030, large-scale string inverters are expected to reach 365 kW per unit, with power density climbing from around 2.76 kW/kg in 2024 to over 3.5 kW/kg. That means more power output at lower manufacturing cost.

- **High DC/AC Overload Ratios**

  Pushing DC input power higher than the inverter's rated AC power — the "overload ratio" — allows systems to maximize annual output and cut LCOE. Mainstream models now exceed 130%, while leading solutions hit 160% or more, thanks to wide MPPT voltage ranges and intelligent dynamic derating that adjusts output in real time.

- **Topology Innovation**

  To handle higher voltages and boost efficiency, three-level topologies (such as NPC and ANPC) have become standard in high-power inverters. At 2,000 V and beyond, research is moving into five-level and multi-level designs, further improving waveform quality, reducing stress on devices, and lowering losses.

Reliability as the Lifeline

PV plants operate in tough, variable conditions — which means inverter reliability is non-negotiable. Advances are focusing on safety, protection, and predictive maintenance.

- **DC Arc Fault Detection and Interruption (AFCI)**

  Arc faults are a major fire risk. The latest string inverters use advanced sensors and AI-driven algorithms to achieve near-perfect detection rates and extinguish arcs in under 500 ms. Challenges remain in long-cable and high-current scenarios, but detection accuracy is improving rapidly.

- **Structural Safety and Explosion-Proof Design**

  Outdoor inverters typically achieve IP65 or higher protection. To address risks from internal faults, new designs combine reinforced enclosures with intelligent pressure relief — such as predefined rupture paths and venting channels — to safely release pressure without sacrificing sealing.

- **Intelligent Monitoring and Predictive Maintenance**

  Instead of reacting after faults, inverters are shifting to predictive models. Using precise insulation monitoring, temperature sensing, and capacitor health checks, combined with edge/cloud AI algorithms, operators can identify risks early and carry out preventive maintenance.

Value Expansion: Control and Smart O&M

As renewable penetration rises, inverters are becoming active participants in grid stability and plant operation.

- **Grid-Forming Capability**

  Advanced control strategies — such as Virtual Synchronous Generator (VSG), droop control, and Virtual Oscillator Control (VOC) — allow string inverters to provide inertia and damping in weak grids. Some 320 kW+ units can now operate stably at SCR ≥ 1.1 and even deliver black-start capability. The next frontier is fault ride-through and interoperability across different strategies.

- **Power Quality and Harmonic Suppression**

  Using fast DSPs, optimized modulation, and active filtering, modern string inverters can keep total harmonic distortion (THDi) below 3%, even under complex grid conditions.

- **AI-Driven O&M**

  AI is transforming operations: minute-level forecasting, second-level IV curve scans, and AI-based fault recognition all help operators run plants more efficiently. The challenge now is integrating diverse data sources — from weather and grid data to module imagery — into actionable insights.

Industry Foundations: Semiconductors and Localization

Performance gains depend on breakthroughs in core components — and in supply chain security.

- **Silicon Carbide (SiC)**

  SiC MOSFETs boost efficiency above 99%, increase power density, and reduce cooling needs. High costs limit use to premium models today, but rapid capacity growth and cost reductions will drive broader adoption.

- **Gallium Nitride (GaN)**

  GaN is already used in microinverters and auxiliary circuits, with engineering trials underway in higher-power applications. As costs drop and voltage handling improves, GaN will play a bigger role.

- **Localization**

  China is rapidly closing the gap in IGBTs, SiC modules, and control chips. By 2024, localization rates hit nearly 40% for 1,500 V string inverter power modules. Domestic MCUs are also gaining traction in mid- and low-power products. Localization strengthens supply chain resilience and cost competitiveness.

Conclusion

The string inverter industry is in a period of accelerated innovation. High-voltage platforms, advanced control strategies, predictive O&M, next-generation semiconductors, and localized supply chains are converging to deliver higher efficiency, lower costs, and greater reliability.

Looking ahead, string inverters will not only consolidate their dominance over centralized designs but also become central to new scenarios: commercial rooftops, residential PV, and PV-plus-storage systems. With their evolving intelligence and grid-support capabilities, string inverters are moving from passive power converters to active energy managers.

For Ginlong (Solis) Technologies and other Chinese manufacturers at the forefront of these developments, the opportunity is clear: lead in technology, scale globally, and make a lasting contribution to the world's clean energy transition and the achievement of dual-carbon goals.

DR. ZHANG
CHIEF EXPERT
GINLONG (SOLIS) TECHNOLOGIES

PROJECT FEATURE

FIMER Powers Nicaragua's Renewable Growth with the SAN ISIDRO Solar Project

Reinforcing global leadership through advanced modular inverter solutions

FIMER, a global pioneer in solar inverter technology, continues to strengthen its global footprint with the successful completion of the **SAN ISIDRO Project** in Nicaragua. Commissioned by **Nordic Solar S.A.** and successfully **completed in July 2025,** this milestone installation stands as a testament to FIMER's engineering excellence and unwavering commitment to advancing clean energy solutions worldwide.

Project Overview

The SAN ISIDRO Project represents a significant step forward in Nicaragua's renewable energy landscape. Its goal was to establish a modular, skid-based power conversion infrastructure designed to efficiently channel solar-generated electricity into the medium-voltage grid. Through this initiative, FIMER has delivered a robust, scalable, and easy-to-maintain system that enhances grid reliability while supporting the nation's sustainability ambitions.

At the core of this achievement lies **FIMER's PVS980-CS Compact Skid solution** — an advanced, plug-and-play power conversion system integrating inverter, transformer, and MV switchgear into a single, pre-engineered unit. The installation features **four skids,** each rated at **4,782 kVA,** for a total installed capacity of **19.128 MVA.** Built to endure challenging environments, the system operates effectively from -20°C to +50°C and offers **IP54/IP55-rated protection,** ensuring exceptional performance in Central America's tropical climate.

Engineering and Execution Excellence

The project's implementation followed a structured five-phase plan — encompassing **site preparation, precision equipment installation, DC/AC/MV interconnections, rigorous testing,** and final g**rid synchronization** in July 2025. FIMER's meticulous planning and seamless coordination ensured timely delivery and flawless execution.

Key challenges such as **logistics, environmental protection, and grid harmonics control** were successfully mitigated through specialized engineering practices and close collaboration with local stakeholders. The modular, **factory-tested skid design** played a pivotal role in minimizing installation time and ensuring long-term serviceability, underlining FIMER's expertise in delivering dependable, high-performance systems.

Distinctive Features

The SAN ISIDRO project showcases several standout advantages of FIMER's technology:

- **Plug-and-play modular skid design** for faster commissioning.
- **Optimized thermal and sealing systems** suited for tropical climates.
- **Scalable configuration** enabling future capacity expansion.
- **Pre-assembled, factory-tested systems** ensuring reliability and quality.
- **Alignment with Nicaragua's national renewable energy vision**, advancing clean power accessibility.

With a total installed capacity of **19.128 MVA,** the SAN ISIDRO project further reinforces FIMER's position as a trusted partner in utility-scale renewable energy development. It also exemplifies how innovation, modularity, and sustainability can converge to empower nations on their clean energy journey.

ABOUT FIMER

FIMER is a global leader in solar inverter technology, shaping the future of renewable energy with one of the most comprehensive portfolios of solar and storage systems for every application. For FIMER, investing in solar energy is not just a business decision—it represents a strategic commitment to building a cleaner and more sustainable world for future generations.

The company is dedicated to delivering clean, affordable, and reliable energy solutions that empower people, uplift communities, and protect the planet.

FIMER in India

Since 2010, FIMER India has been at the forefront of the country's inverter manufacturing sector. Headquartered in Bengaluru, Karnataka, the facility has an annual manufacturing capacity exceeding 15 GW, positioning FIMER as one of the most versatile, experienced, and trusted inverter suppliers in the Indian market.

FIMER's Impact

- **75+ GW** of installed capacity worldwide
- **54,000+ EV chargers** deployed globally
- **Two manufacturing hubs** in Italy and India

FIMER is a brand owned by **MA Solar Italy,** part of the **McLaren Applied Group,** and remains one of the world's leading renewable energy manufacturers. With state-of-the-art production facilities and dedicated local training centers, FIMER continues to strengthen its global presence — staying close to its customers and partners in the ever-evolving energy sector.

PROJECT FEATURE

Huasun Drives Desert-to-Green Transformation with High-Efficiency HJT Solar in Western China

Western China's arid deserts, long defined by drifting sand and fragile ecosystems, are becoming hubs of renewable power thanks to large-scale photovoltaic (PV) development. Capitalizing on more than 3,000 annual sunshine hours and China's national "dual-carbon" strategy, Huasun is helping turn barren lands into clean-energy oases while advancing desertification control.

Policy Momentum

China plans to add 253 GW of solar capacity across its desert, Gobi, and semi-desert regions by 2030, while restoring over 10 million mu (≈670,000 ha) of degraded land. This unprecedented build-out positions desert PV as a cornerstone of the country's energy transition and ecological restoration efforts.

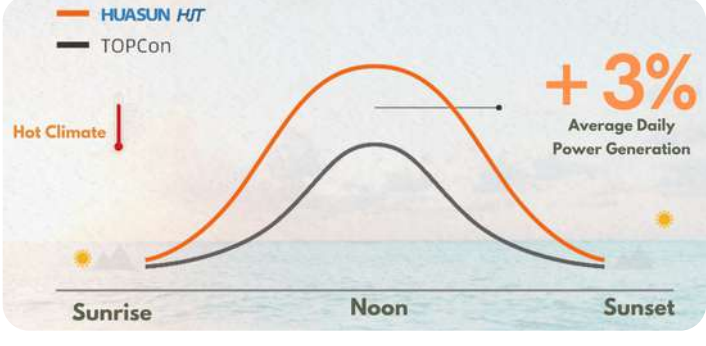
Flagship Projects

A landmark example is the 4 GW Ruoqiang solar project on the edge of the Taklamakan Desert, which began grid-connected operation in August 2025—currently China's largest single-site desert PV plant. Using a "generate above, restore below" model, the project's over 3866 ha of solar arrays lower ground temperatures by 3–5 °C, cut evaporation, raise soil moisture up to 60%, and significantly improve vegetation survival rates, effectively curbing local desertification.

Huasun has supplied heterojunction (HJT) modules for this and other key initiatives, including projects in Bayannur, the southern Kubuqi Desert, Urumqi's Midong District, and multiple long-term performance test sites across Northwest China.

Technology Built for Extreme Conditions

Huasun's HJT modules deliver industry-leading efficiency, bifaciality, and reliability—critical for desert environments with surface temperatures reaching 70 °C. Key features include:



- Outstanding temperature coefficient of -0.24%/°C, ensuring stable output in high heat.
- Ultra-high bifacial factor, leveraging sand reflectivity for greater energy yield.
- Superior low-light response, maintaining performance during dawn, dusk, and sandstorm conditions.
- Proven long-term durability, as demonstrated by year-long field data showing higher and more stable output than conventional P-type and standard N-type modules.

By integrating advanced PV technology with ecological restoration, Huasun is transforming solar arrays into ecological infrastructure. The company's high-efficiency HJT solutions not only maximize plant performance and economic returns but also demonstrate how renewable energy can drive land rehabilitation.

"Huasun is proud to contribute to a scalable 'China model' for combating desertification while accelerating the global shift to renewable power," said Jimmy Xu, Chairman of Huasun.

PRODUCT LAUNCH

SolaX Power Launches 350 kW Utility-Scale Solar Inverter in India

SolaX Power, a global leader in solar inverter and energy storage solutions, has officially launched its next-generation 350 kW Utility-Scale Solar Inverter for the Indian market. To mark this milestone, SolaX Power has hosted a series of exclusive events in recent months to introduce the product and provide hands-on experience to partners, EPCs, and key industry stakeholders.

Powering India's Renewable Growth

India is witnessing rapid expansion in renewable energy capacity, driven by ambitious government targets and growing demand for sustainable solutions. The new 350 kW inverter is specifically designed to cater to India's utility-scale solar projects. It offers superior efficiency, robust reliability, and advanced grid management features, helping developers optimize performance while reducing lifecycle costs.

Key highlights of the new inverter include:

- Efficiency exceeding 99% to maximize energy generation.
- Higher Output at 50Deg C.
- Advanced cooling systems for consistent operation in India's diverse climates.
- Smart monitoring and remote O&M features for simplified asset management.
- Compliance with national grid standards and enabled with latest features i.e. LVRT, HVRT , Night Time SVG and PID recovery and many more

Recent Launch Events

As part of the launch campaign, SolaX Power organized a series of regional events across India. These events not only introduced the 350 kW inverter but also allowed participants to gain hands-on experience, interact with technical experts, and explore practical applications for their projects. The gatherings drew strong participation from distributors, EPCs, and industry leaders, reflecting the market's enthusiasm for the new solution.

Highlights of the events include:

- 12th September 2025 – Coimbatore
- 18th September 2025 – Ahmedabad

Commitment to India's Solar Mission

Speaking on the launch, Mr. Vipin Bhardwaj, Country Manager – India, SolaX Power, said:

"The 350 kW Utility-Scale Inverter represents a significant step in our India journey. It is engineered to support the country's evolving solar landscape with unmatched efficiency, reliability, and intelligent functionality. By conducting these launch events, we have ensured that our partners and EPCs get direct hands-on experience of the product, enabling them to better serve the market and accelerate India's renewable energy growth."

About SolaX Power

SolaX Power is a globally recognized leader in solar inverters, hybrid solutions, and energy storage systems, with a presence in more than 100 countries. The company's mission is to empower a sustainable future through continuous innovation, high-quality solutions, and strong customer partnerships.

Alishan is leading India's solar revolution with Next Generation Materials

India's solar journey has become a national mission, with over 280 GW of solar targeted by 2030 out of 500 GW renewables. The recent GST cut on modules has boosted affordability and adoption, with India already adding 40 GW each year. But long-term reliability depends not just on cells, but on encapsulants and backsheets that protect them for decades.

Alishan Green Energy has stepped up to meet this need. From 800 MW in its early days, the company has expanded to 4.2 GW of encapsulant capacity and is now moving towards 6.6 GW by December 2025, supported by 3 GW of backsheet production. This scale has made Alishan India's largest independent manufacturer of encapsulants and backsheets.

latest product designed for next-gen cell technologies

At Alishan, progress is defined by innovation. This year, we have introduced products tailored to the fast-changing demands of the solar industry.

- Alishan Low Acid EVA reduces acetic acid content, protecting modules from corrosion and extending their lifespan, especially in hot and humid regions.
- Alishan EPE NT supports advanced N-type technologies like TOPCon, HJT, and bifacial modules. Its EVA/POE blend ensures higher transparency, stronger adhesion, and long-life performance.
- Alishan EPE DC goes beyond protection by converting harmful UV light into usable energy. This prevents yellowing and power loss while also boosting module efficiency in low-light conditions.

All products are rigorously tested in our NABL-accredited labs and certified to IEC and UL standards, ensuring our customers that they can rely on world-class quality.

Made in India, strength for a global vision

India's solar industry has long depended on imported raw materials, creating supply risks and higher costs. Alishan Green Energy is changing that by localizing advanced encapsulant and backsheet production. By delivering faster, more reliable supply from within India, we are giving module makers the confidence to scale quickly in domestic as well as global markets.

The road to 10 GW and beyond

Backed by quality, scale, and innovation, Alishan is preparing for its next leap with the expansion to 6.6 GW of encapsulant capacity by December 2025. Our vision for the long term is to cross 10 GW and keep developing new materials for future solar cell technologies.

At Alishan Green Energy, our purpose goes beyond numbers. We want to be a complete solution for solar ancillary materials. Today we are already a one-stop partner for encapsulants and backsheets. We are not here to compete with our customers but to serve them and strengthen India's solar foundation. By building reliability at the core, we are working to make India truly self-reliant in the solar sector.

NIKHIL AGRAWAL
DIRECTOR
ALISHAN GREEN ENERGY PVT. LTD.

SUCCESS STORY

ReNew Strengthens Aatma-Nirbhar Bharat with Pioneering Solar Manufacturing

ReNew, India's leading decarbonisation solutions provider, has marked a major milestone in its clean energy journey with the commissioning of two world-class solar module manufacturing plants and an advanced solar cell facility. These developments not only reinforce the company's commitment to Atmanirbhar Bharat but also strengthen its position as a global sustainability leader driving the energy transition.

Expanding Capacity, Strengthening Supply Chains

ReNew's strategic entry into solar manufacturing in 2021 was a natural progression of its mission to accelerate India's energy transition. In just a few years, the company has built one of the largest solar manufacturing footprints in the country. The commissioning of its 4 GW solar module plant in Jaipur, Rajasthan (2023), and the integrated 2.4 GW module plus 2.5 GW cell facility in Dholera, Gujarat (2024), has taken its operational capacity to 6.4 GW of modules and 2.5 GW of cells. This scale not only positions ReNew as a key contributor to India's renewable energy ambitions but also helps in creating a robust domestic supply chain, reducing import dependency.

Technology-Driven Manufacturing Excellence

The Jaipur facility, spread across 22 acres, was one of the first commissioned under the Government of India's Production Linked Incentive (PLI) scheme for solar manufacturing. With a daily output of approximately 15,000 modules and over 1,400 direct jobs created, it is setting benchmarks in efficiency, scale, and employment generation.

The Dholera plant, situated in Gujarat's Special Investment Region, is even more ambitious in scope. Spread across 55 acres, it integrates both module and cell production under one roof. Equipped with automated packing lines, AI-driven defect diagnostics, and advanced material handling systems, it stands out as one of India's most technologically advanced solar manufacturing facilities. Together, these plants highlight ReNew's focus on operational excellence and innovation-led growth.

Performance, Profitability, and Market Momentum

Since stabilization in Q2 FY26, the plants have consistently delivered at scale, with module production exceeding 12 MW/day and cell production over 5 MW/day. In Q1 FY26 alone, ReNew produced more than 900 MW of modules and 400 MW of cells, with cell efficiencies averaging above 23.3%. The company also reported strong financial results — INR 13.1 billion in revenue and INR 5.3 billion in adjusted EBITDA — driven by cost efficiencies and third-party sales.

ReNew's external order book currently stands at ~800 MW, alongside 1.9 GW already delivered, reflecting strong market confidence in its manufacturing capabilities.

Future-Ready with TOPCon Technology

Looking ahead, ReNew is deepening its backward integration with the development of a 4 GW TOPCon solar cell facility. Supported by a $100 million investment from British International Investment (BII), this project is progressing rapidly with land secured, civil works underway, and major machinery orders finalized. Production is expected to commence by the end of FY27, further cementing ReNew's leadership in advanced solar technologies.

A Global Decarbonisation Leader

With its expanding manufacturing capacity, focus on innovation, and strong financial foundation, ReNew is playing a pivotal role in shaping India's clean energy ecosystem. Its strategic investments not only advance India's self-reliance in solar manufacturing but also enhance its competitiveness on the global stage.

Through scale, technology, and vision, ReNew is powering India's journey toward energy independence and strengthening its position as a global decarbonisation solutions provider.

Markus Sickmoeller

PRESIDENT (SOLAR MANUFACTURING)
RENEW

PRODUCT LAUNCH

Aerem Launches All-in-One Solar Kits for the EPC Market

As India's renewable energy sector accelerates, the need for reliable, pre-engineered, and high-quality solar solutions has become more crucial than ever. Aerem Sunstore India's leading B2B solar procurement platform, has taken a major step forward with the launch of its Solar Kits for the EPC market — designed to simplify procurement, ensure quality, and drive faster solar adoption across the country.

A Trusted Name in Solar Procurement

Aerem Sunstore part of the Aerem's ecosystem, has established itself as a one-stop platform for EPCs, developers, and installers looking for efficient solar procurement solutions. The platform provides modules, inverters, batteries, structures, cables, and other essential BOS components from verified brands at competitive prices.

With a strong presence across major Indian cities, Aerem Sunstore continues to empower solar professionals through trusted partnerships, easy access to high-quality materials, and a seamless procurement experience — all backed by strong technical and sales support.

Introducing Pre-Configured DCR Solar Kits

To further streamline project execution, Aerem Sunstore has launched its range of DCR (Domestic Content Requirement) Solar Kits — an all-in-one solution that simplifies the procurement process for EPC players.

These kits are available in **2.2 kW, 3.3 kW, 5.5 kW, and 10 kW** variants, featuring top-tier brands such as **Waaree, Renew, Emmvee, Growatt, and Polycab.** Each kit includes every essential component — from high-efficiency bifacial DCR solar modules and on-grid inverters to DCDBs, ACDBs, MC4 connectors, lightning arrestors, and earthing systems.

Built with quality-approved components, Aerem Sunstore's solar kits deliver long-term performance, easy installation, and significant time savings by consolidating the entire Bill of Materials (BOM) into one ready-to-install package.

Key Advantages for EPCs and Installers

- **All-in-One Solution:** Complete kits reduce coordination and sourcing complexity.
- **Quality Assurance:** Components from reputed brands ensure durability and compliance.
- **In-House Engineering Support:** Design and mounting guidance available from SunStore experts.
- **Exclusive Financing:** Up to 100% financing with competitive interest rates.
- **Dedicated Sales & Customer Support:** On-ground assistance from SunStore's experienced team.

Empowering the Next Phase of Solar Growth

By introducing pre-engineered solar kits, Aerem Sunstore aims to redefine efficiency for EPC players, allowing them to focus on project execution rather than procurement challenges. With trusted partnerships, financial flexibility, and engineering support, Aerem Sunstore is not only simplifying solar deployment but also accelerating India's journey toward a sustainable, self-reliant energy future.

Explore more at: www.sunstore.co
Contact: +91 97697 32131
Email: connect@aerem.co

COMPANY FEATURE

PVblink : Powering India's Solar Future

PVblink Technology Pvt. Ltd., a Gujarat-based **Make-in-India manufacturer,** is redefining the standards of solar inverter innovation for residential, commercial, and industrial applications. With a commitment to reliability, efficiency, and digital intelligence, PVblink delivers advanced solar power solutions designed to address India's growing renewable energy needs. The company's comprehensive product portfolio includes **On-Grid, Off-Grid, Smart Switch, All-in-One inverter series and BESS** offering superior performance and adaptability for every energy environment.

At the heart of PVblink's success lies its dedicated **in-house R&D team** that continuously works on performance optimization, design enhancement, and cost-efficiency. Every inverter is built to perform efficiently even in low-light conditions with **ultra-low start-up voltage** (30–40V), higher PV **overloading capacity** (up to 50%), and strong MPPT current handling (up to 18A per string).

PVblink's Make-in-India manufacturing ecosystem ensures end-to-end control — from design to delivery — maintaining high quality under strict **ISO, BIS, and IEC** certifications. With a strong supply chain network and on-time logistics support, the company ensures seamless delivery even during high demand periods across India.

Product Portfolio

On-Grid Inverters: Designed for efficient power generation with low-voltage start-up and enhanced safety, ensuring maximum ROI for installers and EPCs.

Off-Grid Inverters: Delivering uninterrupted performance with powerful battery backup and fast switchover—ideal for remote and rural areas.

Battery Systems: Our batteries feature an indigenously developed BMS, fully designed and made in India - unlike most imported systems. This ensures smarter protection, stable performance, and seamless integration with our hybrid and off-grid inverters.

All-in-One Series: Compact systems combining inverter and controller in a single unit, offering simplified installation and reduced project costs.

Smart Switch: A breakthrough solution that allows existing on-grid systems to be upgraded into hybrid setups, supporting battery integration and PM-KUSUM projects for agricultural solarisation.

Empowering Smart Solarisation

We have developed our own on-cloud monitoring platform, with servers located safely within India. This ensures that all system data stays secure in the country, fully aligned with the Government of India's push for Make in India and data localization. The company has developed data logger to comply the MNRE guideline for M2M SIM compatible, allowing remote access and long-term data logging to track performance and system health effortlessly.

Expanding Horizons and Global Vision

PVblink's market reach extends across PAN-India, serving both rural and urban solar ecosystems through an efficient sales and service network. The company now looks toward international expansion in emerging renewable hubs, backed by strategic partnerships and local compliance initiatives.

Its service strategy combines rapid technical support, video-call assistance, and pickup-drop replacement warranty for ultimate customer satisfaction. This model ensures reliability and strong after-sales engagement for distributors, EPCs, and end users alike.

PVblink's mission is simple yet powerful — to make solar smarter, stronger, and truly Indian. By combining world-class technology, reliable service, and a customer-first approach, PVblink continues to empower EPCs, distributors, and installers with dependable products that deliver consistent performance and sustainable value for decades.

PRODUCT LAUNCH

India's Solar Revolution Gains a Gigawatt-Scale Boost: Macwin Solar Launches State-of-the-Art TopCon G2G Factory in Surat

In a landmark development for India's burgeoning solar sector, Macwin Solar Energy Pvt. Ltd. has announced the successful completion and launch of its new, highly-advanced TopCon Glass-to-Glass (G2G) module factory in Bhatgam, Surat, Gujarat. The facility's operational debut, underscored by the successful testing of its first module, solidifies Macwin Solar's rapid transformation into a major player in the renewable energy manufacturing landscape.

The Surat-based factory is equipped with cutting-edge automation and technology, specifically designed for the production of high-performance N-Type TopCon G2G (M10R & G12R) solar modules, an advanced technology known for superior efficiency, lower degradation, and enhanced durability. The strategic location in Gujarat, a hub for solar manufacturing and project development, positions Macwin Solar to efficiently cater to both soaring domestic and international demand.

From Megawatts to Gigawatts: A Trajectory of Exponential Growth

The factory launch marks a dramatic acceleration in Macwin Solar's growth journey. The company, established in 2021 and operational by 2022, has vaulted from an initial production capacity of 50 MW to now setting its sights on a monumental 2 GW target by the end of 2025. This exponential increase in scale reflects Macwin's decisive commitment to the 'Make in India' and 'Atmanirbhar Bharat' initiatives within the green energy space.

The rapid capacity expansion, leveraging high-efficiency technologies like N-Type TopCon, is perfectly timed to meet India's ambitious clean energy goals. With the nation crossing the 100 GW solar capacity mark and relentlessly pursuing a 500 GW non-fossil fuel target by 2030, domestic manufacturing scale and technological innovation are paramount.

Commitment to Quality and Innovation

Speaking on the milestone, **Mr Bharat budheliya and Mr hardik budheliya MD of macwin** Solar Energy, emphasized the company's dual focus on quality and national commitment.

"This new factory is a major milestone for Macwin Solar Energy. Successfully testing our first TopCon G2G module underscores our dedication to delivering high-performance and reliable solar solutions," stated Mr. Budheliya. "We are committed to supporting India's renewable energy goals with world-class products and sustainable innovation. The TopCon G2G technology ensures our modules not only meet but exceed the stringent performance and longevity requirements of utility, commercial, and residential customers worldwide."

The G2G module design, in particular, offers better protection against environmental factors and significantly reduces the annual degradation rate of the panels, offering a higher energy yield over the module's lifetime—a crucial advantage for large-scale and long-term solar projects.

Global Reach, Local Impact

The expanded, high-tech manufacturing capacity is poised to give Macwin Solar a significant competitive edge. The company is now in a strong position to offer faster delivery timelines and consistently superior-quality solar modules, thereby strengthening its market share across all Indian states and accelerating its push into global markets, including the MENA region and Africa.

The Bhatgam facility is more than just a production line; it is an investment in sustainable infrastructure. It represents a key stepping stone in integrating advanced technologies like TopCon into the core of Indian solar manufacturing, ensuring the country remains at the forefront of the global energy transition. Macwin Solar Energy is not just powering homes and businesses; it is fueling India's ascent as a global renewable energy leader.

HARIRAJAN. R

CEO
I.P.L. PRODUCTS

Precision, Performance, and Progress in Every Transformer

KEY HIGHLIGHTS:

- *I.P.L. PRODUCTS has grown into a key renewable player, delivering 3.5 GW of solar and wind projects since 2020.*
- *Its advanced design and testing ensure reliable, high-performance transformers for demanding conditions.*
- *Strong partnerships and R&D drive its vision to become a complete renewable solutions provider by 2030.*

We are not just transforming transformers; we are transforming our role into a trusted architect of India's renewable energy future.

Q I.P.L. PRODUCTS has ventured into renewable energy; can you share the journey and your strategic vision for this sector?

Since its humble beginnings, I.P.L. PRODUCTS has grown steadily through decades of innovation and dedication. What started in 1974 with the manufacturing of Cast Iron Jointing Kits soon evolved into a trusted name in the electrical industry. In 1982, we developed open-type pillar boxes, followed by the production of 11 kV isolators (A.B. switches) in 1986. In the Year 1996, we ventured into transformer manufacturing, Starting with distribution transformers and later, in 2006, expanding into power transformers, and In 2014 Collaborated with Jean Muller, Germany for Energy Efficient HRC Pillar boxes.Today, we are proud to be among the few manufacturers in Tamil Nadu capable of producing transformers up to 50 MVA, 110 kV class and Isolators up to 400 kV.

Our next leap came in 2020, when we stepped into the renewable energy sector, focusing on solar and wind transformers. Since then, we have successfully supplied transformers with a combined capacity of over 3.5 GW for solar projects, strengthening our role in India's clean energy ecosystem.

Our strategic vision is simple yet ambitious — to position I.P.L. PRODUCTS as a one-stop renewable energy solutions provider. Beyond transformers, we are developing hybrid and energy storage interfaces designed to deliver superior efficiency, reliability, and long-term value. Aligned with India's "Net Zero by 2070" commitment, we aim to support the nation's mission to expand non-fossil energy capacity and promote Make-in-India manufacturing.

India's renewable energy journey is inspiring. As of mid-2025, non-fossil sources make up around 50% of India's total installed capacity (484.82 GW) — a milestone achieved five years ahead of schedule. The country now ranks 4th globally in renewable capacity, 3rd in solar, and 4th in wind. At COP-26, India pledged to reach 500 GW of non-fossil energy by 2030, and we are proud to contribute to that mission.

At I.P.L. PRODUCTS, quality and reliability are non-negotiable. Every product we design goes through IS/IEC testing standards. We use high-grade core steel, insulation, and advanced manufacturing processes to ensure consistent performance even in challenging site conditions. Our focus on predictive maintenance and remote monitoring helps maximize uptime and reduce lifecycle costs — critical for large-scale renewable installations.

Collaboration is another key to our success. We partner with top EPC players, renewable developers, and NABL-accredited laboratories, Government Testing Laboratories for validation and testing.We also work closely with leading suppliers to source the latest magnetic and insulating materials suited for solar and wind transformer applications.

Looking ahead, we envision I.P.L. PRODUCTS becoming a national and global name in renewable infrastructure. Over the next decade, our focus is to expand our presence across India and international markets, with strong capabilities in Distribution, Power, Solar & BESS (Battery Energy Storage System) transformers.

Q How does I.P.L. PRODUCTS ensure reliability and longevity in renewables energy products for large-scale projects?

At I.P.L. PRODUCTS, reliability isn't just a promise — it's the foundation of everything we build. Every renewable energy transformer and component goes through a series of design validations, Type tests, and quality checks in line with IS/IEC standards to ensure the highest performance and safety.

We use advanced design software to simulate real-world operating conditions, making sure our products perform efficiently even in the toughest environments — from desert heat to coastal humidity. Our manufacturing process involves vacuum drying, precision winding, and multi-stage oil filtration to achieve superior insulation strength and longer service life.

Our manufacturing process is built on precision. The core assembly and coil alignment are done using precision jigs to minimize losses and vibrations, extending operational life. Each stage of production is monitored by a dedicated quality control team, ensuring zero deviations from design parameters.

The R&D and design team at I.P.L. PRODUCTS continuously innovate to improve efficiency and reduce losses. Every material we use is selected after detailed testing and verification. Our core laminations are made from premium-grade CRGO steel with high magnetic permeability, while conductors are drawn from certified electrolytic copper for superior conductivity.

The insulating components — including runners, spacers, and rings — are sourced from PGCIL and NTPC-approved manufacturers, ensuring reliability under stress. We also use TUPC (Class-E) conductor covering, capable of withstanding temperatures up to 120°C, offering additional protection against overheating — vital for solar and wind transformers operating continuously in variable conditions.

Our oven curing process guarantees moisture-free insulation, while our tank fabrication and testing procedures, conducted per IS 1180 and IS 2026, ensure structural integrity, leak- proof performance, and pressure resistance. Every transformer undergoes routine, type, and special tests before dispatch — including induced voltage, impulse, and temperature-rise tests — to validate its performance under extreme conditions.

At the heart of all these processes is a simple belief — quality is built, not inspected. Every transformer that leaves our factory is a reflection of our engineering passion, our commitment to safety, and our promise of reliability to every partner who trusts I.P.L. PRODUCTS.

Q Could you highlight key Partnerships Collaborations that enhance I.P.L. PRODUCTS renewable energy offerings?

At I.P.L. PRODUCTS, we believe good partnerships make strong progress. Our growth in the renewable energy field is not just because of what we build, but also because of who we work with, Our strength lies in our retained clients, built on the foundation of quality and service.

We have a long-standing marketing & service partnership with ARROW MARKETING, who help us reach the right customers across India. They understand our products and values, and that helps us connect better with industries, EPCs, and government projects.

Our base strength lies in our vendors. We treat them as partners of the company, ensuring prompt payments so that we receive our products on time and with the best quality; this ensures the same to our client.

On the supply side, we proudly work with government bodies for distribution and power transformer supplies. These partnerships have given us the chance to contribute to reliable power networks and public energy infrastructure.

In renewable energy, our collaborations with EPC contractors and A-grade Electrical Consultants & Contractors have been key to our success. Because of our continuous quality improvement and prompt service, lead us to convert our customers into clients.

Together, we've delivered transformers for solar, wind, and BESS (Battery Energy Storage System) projects across the country. Each project teaches us something new and helps us improve our product design and service quality.

We also support our partners after installation by offering preventive maintenance tips, technical assistance, and fast response whenever needed. For us, it's not just about selling transformers; it's about standing with our customers for the long run.

These partnerships make I.P.L. PRODUCTS stronger every day. When our partners grow, we grow with them. Our aim is to keep expanding our network — both in India and globally — and keep contributing to India's renewable energy goals and the Net Zero 2070 vision.

At the end of the day, we build trust, relationships, and a vision for a cleaner and brighter future.

Q Where do you see I.P.L. PRODUCTS in the renewable energy sector in 5-10 years, and what are your long term goals?

In the next 5 to 10 years, I see I.P.L. PRODUCTS growing into one of India's most trusted partners in renewable energy — not just for transformers, but as a complete energy solutions company.

The central government has already laid out aspiring goals that guide our path. For example, India has committed to reaching 500 GW of non-fossil capacity by 2030 Also, India has crossed the milestone where non-fossil sources account for about 50 % of total installed electricity capacity ahead of schedule.

Prime Minister Modi said that India's future lies in clean energy, clean growth, and a sustainable lifestyle. These signals guide how we build our roadmap. So in 5 to 10 years, we aim to align our R&D, manufacturing, and product portfolio directly with those national targets.

Here's how we plan to do it:

We'll expand our renewables-focused R&D — designing more efficient, lighter, smart transformers for solar, wind, and BESS applications.

We'll strengthen our test labs and prototyping facilities so we can quickly validate and certify new innovations that meet government or international specifications.

We aim to increase export presence to markets in Africa, Southeast Asia, and the Middle East, where renewable adoption is accelerating.

We're continuously investing in R&D — improving our product designs to make them more compact, efficient, and environment-friendly. Our engineers are working on IoT-based monitoring, allowing customers to track transformer health in real time and predict maintenance before issues arise.

Over the coming years, we plan to scale our capacity and set up a dedicated green manufacturing unit focused on renewable and hybrid systems.

In parallel, we will keep strengthening our manufacturing base in India — more automation, higher quality, lower cost — to support "Make in India" and become globally competitive.

VISHAL NATANI

Founder & CEO
Logics PowerAMR

Transforming the Future of Solar Plant Management

KEY HIGHLIGHTS:

- *Logics PowerAMR unifies all solar plant data under one intelligent platform for seamless, centralized management.*
- *It goes beyond SCADA with multi-layer integration, one-minute precision, and 99.99% uptime for complete digital control.*
- *Deployments cut downtime by 40% and improved PR consistency through real-time, reliable data access.*

Q What inspired the transformation journey in solar plant management?

The transformation began with a simple observation: solar plants were generating power, but not generating clarity.

We saw data scattered across devices, formats, and portals limiting how much operators could actually optimize.

Our goal was to enable centralized management by bringing every component under one digital roof from SCADA and PPC to WMS, PM-KUSUM, DG sync, ZED, Hybrid, Battery systems making solar plant operations truly intelligent, accessible, and reliable.

That's what inspired the creation of Logics PowerAMR a platform built to empower the future of solar automation.

Q Can you tell us more about your Product and Solution Ecosystem?

Our Ongoing Flagship Products include:

SCADA- Customized Hardware Software SCADA solution integrates all solar assets, DI/AI signals, and field devices enabling comprehensive local and remote monitoring, control, and automation for precise plant performance and grid compliance.

DG Sync, Hybrid Control & Zero Export Device (ZED): Automatic synchronization and export control for seamless Solar–DG–Battery operation — ensuring uninterrupted, efficient, and optimization of solar power.

RMS (Remote Monitoring System): Centralized real-time monitoring of solar, hybrid, and DG systems- delivering instant visibility and control across distributed assets.

WMS (Weather Monitoring System): Accurate environmental parameter tracking for performance analytics.

CMS (Centralized Management Platform): Unified data acquisition across all solar assets, providing accurate, actionable insights into plant performance and reliability.

Smart Data Loggers: Multi-protocol compatible devices for seamless integration of inverters, meters, and controllers — bridging communication across diverse hardware.

Advanced Wireless Systems: Our wireless communication devices enable high-speed, interference-free data exchange between DGs, inverters, and control panels — even across large or multi-building installations.

Q What new technologies, products or innovations has your company developed or launched in 2025 ?

At Logics PowerAMR, we continue to expand our product line — integrating intelligence, reliability, and flexibility across every layer of solar and energy automation.

Our new product launches for 2025 focus on smarter, more connected, and future-ready solutions designed to simplify operations, enhance efficiency, and empower our clients:

- **SCADA & RMS for PM-KUSUM Component A & C**

  As part of the Government of India's PM-KUSUM initiative, we've launched integrated SCADA and RMS systems capable of seamless data transmission to SEDM and MNRE portals. Already deployed across 500+ MW of live projects, ensuring compliance, transparency, and effortless remote access.

- **Your Hardware, Our Software**

  A breakthrough solution enabling API-based integration of any third-party or inverter stick logger to connect directly into our Centralized Management Platform.

  Over 5000+ sites are already live offering clients complete flexibility and freedom from hardware lock-in.

- **Custom Theme Dashboards**
  Smartly engineered, fully customizable dashboards for DG Sync, SCADA, Zero Export, WMS, PM-KUSUM, Battery, and Hybrid systems.

  Delivering intuitive visualization, brand-aligned design, and effortless control tailored to every client's need.

- **SCADA & PPC for Utility-Scale Solar Plants**
  Our advanced SCADA system now supports local monitoring, control, and reactive power management, fully integrated with SLDC data transmission (IEC 104) protocol. Successfully implemented across MW-scale plants, enabling grid compliance and high-performance communication.

- **Hybrid inverter and Battery EMS**
  Delivered to leading OEMs, this intelligent Energy Management System provides a unified platform to monitor and control hybrid inverters and battery systems, ensuring precise grid synchronization and optimized power flow between solar, grid, and storage for maximum efficiency and reliability.

Q How is your platform different from conventional SCADA or monitoring systems?

Unlike traditional systems that are often site-specific or vendor-locked, our platform offers:

- Consistent one-minute data frequency without any missing points and instant five-year retrieval — ensuring accuracy and long-term reliability.
- Multi-layered management integrating SCADA, HMI, PM-KUSUM, DG Sync- ZED, WMS, and even BESS — all in one place.

- Custom theme dashboards, and Integration with third-party systems — making it highly flexible and compatible.
- We use redundant communication layers and cloud synchronization to ensure zero data loss and 99.99% uptime
- White labeling options, allowing partners or EPCs to use their own branding.
- Scalability from kW to MW level, covering everything from rooftop plants to large-scale utility projects.
- Comprehensive analytics and performance intelligence highlights underperforming plants, inverters, or strings, enabling faster diagnosis and action.
- API-level interoperability to connect any third-party data logger or device effortlessly to our centralized management system.
- Exhaustive and comprehensive mobile app enabling full functionality at your fingertips, enabling plant monitoring, analytics, and control on the go.

Whether it's a small rooftop or a 100MW utility-scale site, our system adapts seamlessly — ensuring data consistency and complete scalability.

In short, we go beyond monitoring — we enable complete digital management, advanced analytics and performance intelligence for solar assets.

Q Can you share a success story or measurable impact from your recent deployments?

One of our portfolio-wide deployments connected dozens of solar plants across states under a single centralized platform.

Within weeks, we saw downtime drop by nearly 40% and PR consistency improve by 2–3%.

Operators could access real-time and 5-year-old data instantly, detect deviations at a 1-minute frequency, and act immediately.

The client appreciated how the system maintained continuous data without a single missing record — with uptime exceeding 99.99%, even under variable network conditions.

Q How do you ensure accuracy, data integrity, and system uptime across large portfolios?

We use redundant communication layers and cloud synchronization to ensure zero data loss. All data is validated directly from inverters and sensors through secured IoT gateways.

We maintain 99.99% uptime, 1-minute resolution, and instant data recall across five years.

Our servers, APIs, and devices are continuously monitored, ensuring every point of data is reliable, traceable, and ready for audit.

Q What message would you give to solar developers and investors about digital transformation?

I would say that digital transformation is no longer optional — it's the foundation of sustainable, scalable, and profitable solar operations.

Investing in an intelligent platform ensures you have transparent performance metrics, real-time command, and long-term reliability.

Automation, white labeling, and centralized management are not just features — they are strategic tools that protect your revenue and reputation.

At Logics PowerAMR, we see digital transformation as a partnership with our clients — it's about giving them control, confidence, and clarity in every decision, while enabling smarter, greener, and more profitable solar assets.

Q How do you envision the "future solar plant" of 2030?

I think the solar plant of 2030 will be a fully connected, intelligent ecosystem, where every asset — from solar modules and batteries to hybrid systems — communicates seamlessly and makes decisions autonomously.

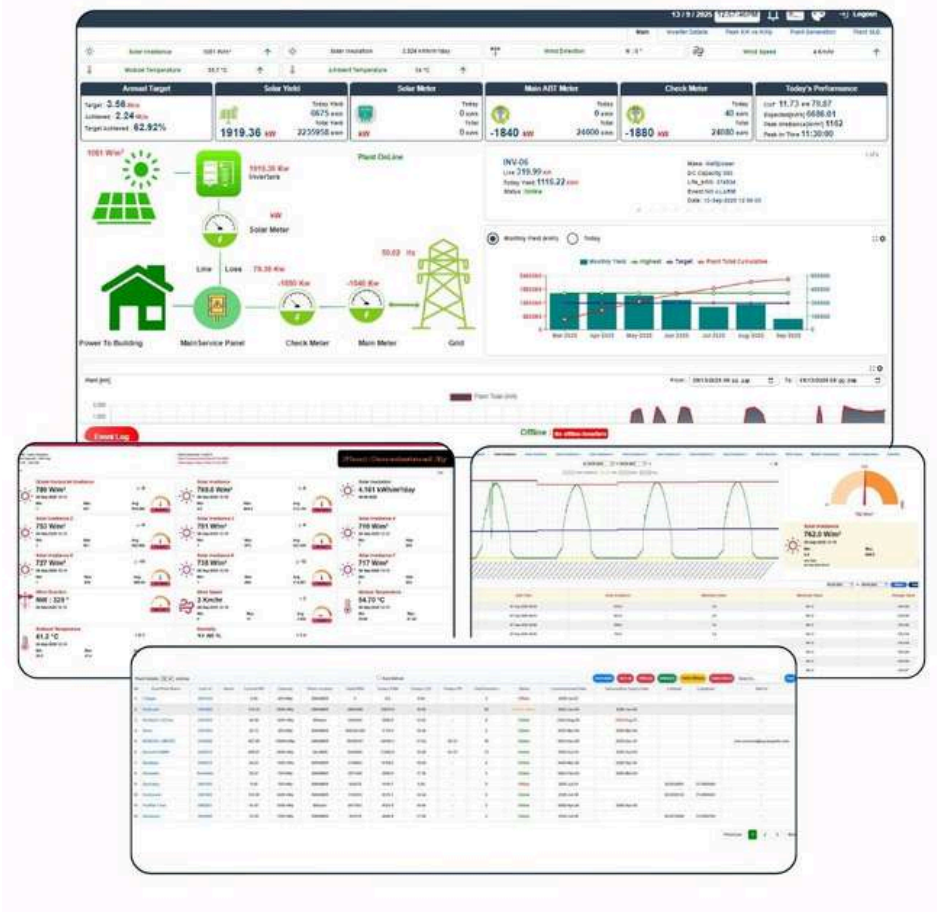
I imagine real-time analytics, predictive maintenance, and AI-driven optimization will become standard.

Beyond technology, the real transformation will be in how customers experience it. They won't need to worry about monitoring or efficiency — because the system itself will handle it, giving them peace of mind, reliability, and maximum return.

In that future, I see Logics PowerAMR's role deeply embedded in the customer journey not just as a provider, but as a trusted partner ensuring every solar asset performs optimally, every day.

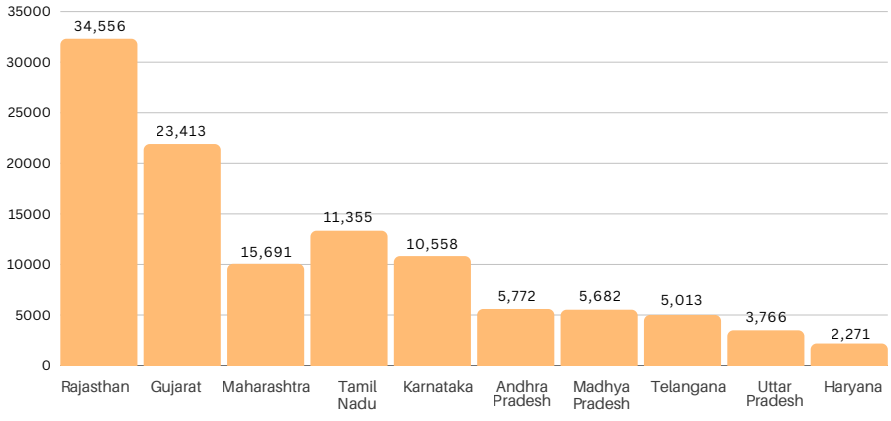
Ultimately, the most valuable innovation isn't just smarter solar technology — it's a simpler, more empowering experience for the people who rely on it.

And we at Logics PowerAMR are building that future today.



Solar Installations by State

TOTAL SOLAR PV INSTALLATIONS AS OF SEPTEMBER, 2025 (MW)

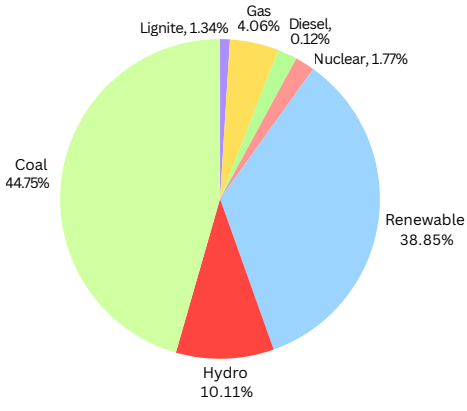


SOURCE: MNRE **SOLARQUARTER RESEARCH**

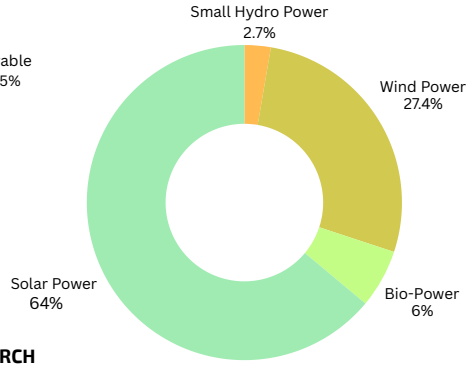
India achieved a remarkable milestone by installing an unprecedented 29,467.57 MW of Solar PV capacity in the calendar year 2025 till September. By the end of Q3 2025, the country's total Solar PV installations surpassed 127 GW. During this period, rooftop Solar PV installations reached approximately 21.52 GW. Rajasthan led the way, with 34,555.87 MW installed, accounting for 27.14% of the nation's total Solar PV capacity. The county also added around 29 GW in the first three quarter of the calendar year 2025. Rajasthan, Gujarat, Maharashtra, Tamil Nadu, and Karnataka together contributed over 75.06% of the total installed Solar PV capacities across the country. While Rajasthan and Gujarat maintained their leading positions, Maharashtra stepped up two spots to its position, pushing Tamil Nadu and Karnataka down to fourth and fifth place compared to installed solar PV capacity by September 2024. The overall Solar PV installations saw a growth of over 40.29% compared to the 90.762 GW recorded by the end of September 2024.

In the pie chart, Renewable capacity additions continue to increase at a rapid pace in India, accounting for approximately 38.85% of India's total power capacity at the end of August 2025. India's total installed power capacity stood at over 495.5 GW at the end of August 2025 from all the sources, with renewables accounting for 192.5 GW, making up 38.85%, compared to cumulative renewable energy installations of 152.6 GW at the end of August 2024, which represented a growth of over 26% year-over-year. Solar power accounted for approximately 123 GW of installations, which represents 24.8% of the total installed power capacity. Among the renewable, Wind and Solar constitute over 91% of the total renewable (excluding large hydro), Wind Power installed capacity at the end of August 2025 was over 52.6 GW, which represents 10.63% of the total power capacity installed.

INDIA POWER MIX

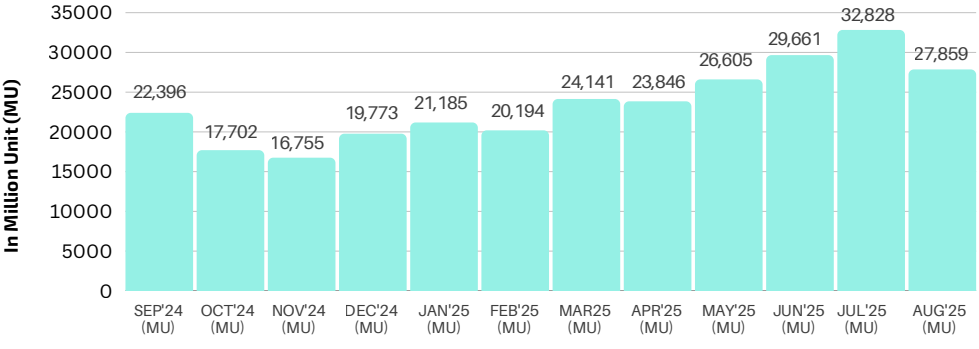


INDIA RENEWABLE MIX



SOURCE: CEA AUG 2025 | SOLARQUARTER RESEARCH

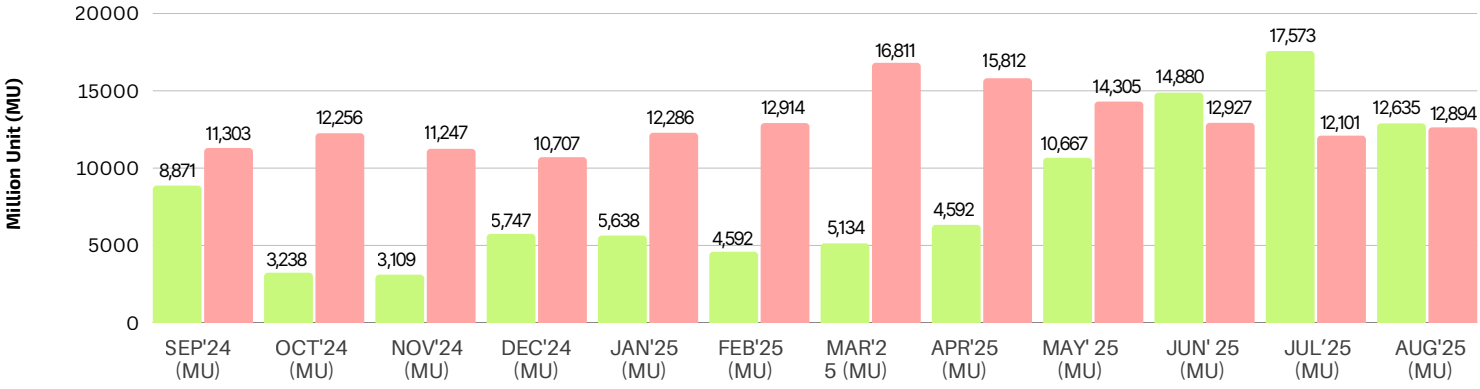
Monthly RE Generaton in India



SOURCE: CEA **SOLARQUARTER RESEARCH**

Total renewable energy generation in September 2025 reached 27,859.13 million units, which is an increase of RE generation by around 22.70% year-over-year from September 2024, when the RE generations were 22,396.06 million units. Solar Power generation has also increased by around 11.79% year-over-year from September 2024 (11,302.62 million units) to September 2025 (12,634.94 million units). Wind Power generation has increased by almost 45.35% in the same period and reached 12,893.73 million units in September 2025.

Solar Vs Wind Generation In India In 2024-25



SOURCE: CEA

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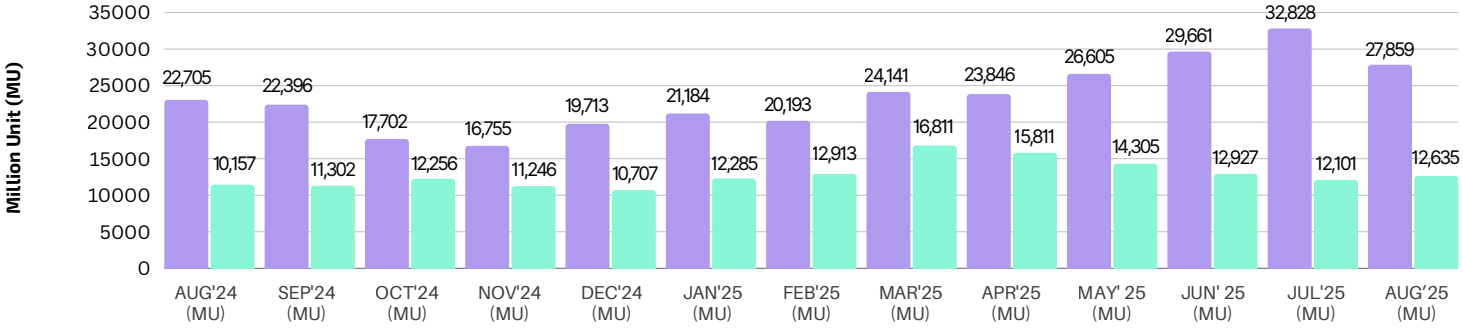
Renewable Energy Vs Solar Generation



SOURCE: CEA

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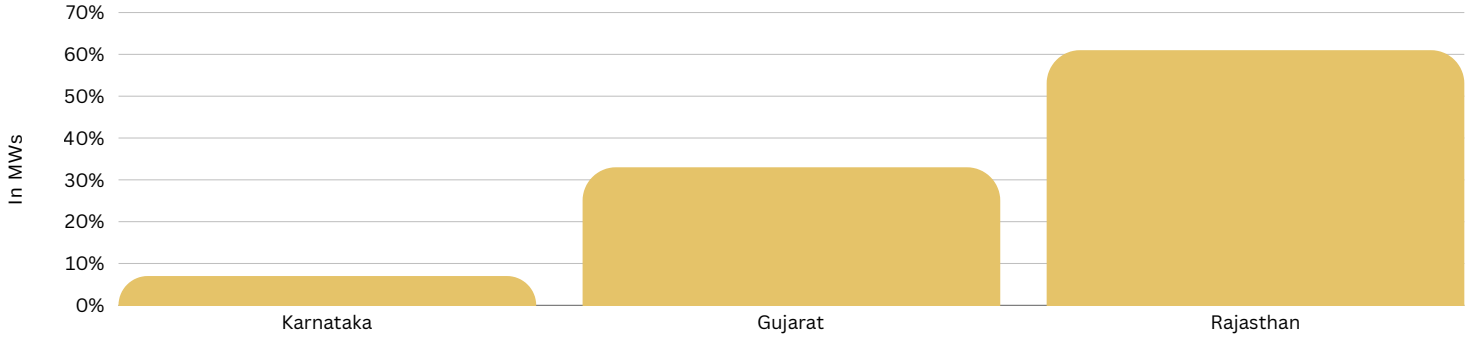
Hybrid Projects (Solar Component)



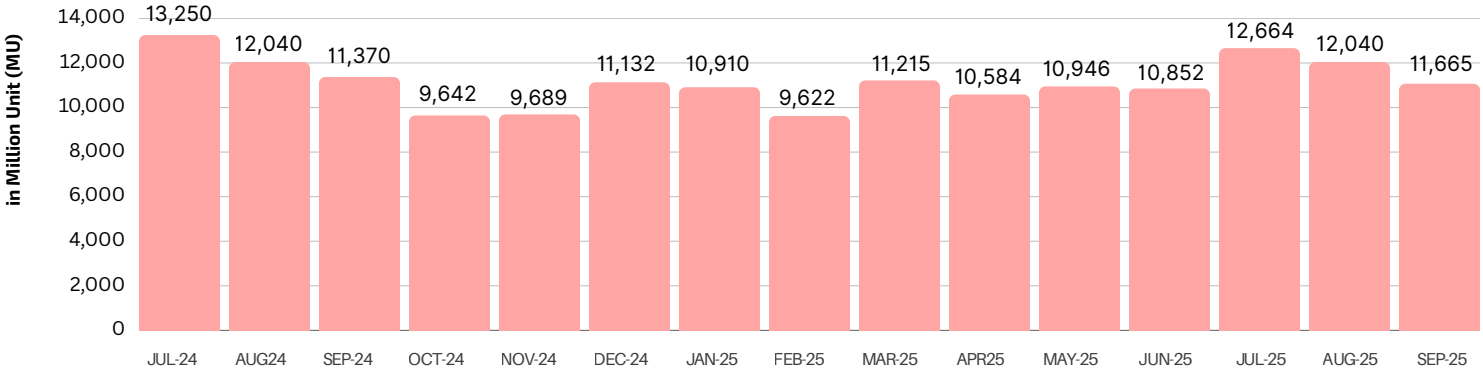
SOURCE: MNRE (SEPTEMBER 2025)

SOLARQUARTER RESEARCH

As of September 2025, India's installed hybrid projects capacity reached 3,256.78 MW, contributing around 2.56% to the country's total solar PV capacity. This is part of the overall renewable energy capacity of 197.2 GW, excluding large hydro. Hybrid projects, which combine solar and wind power, are currently limited to just three states: Rajasthan, Gujarat, and Karnataka. Among these, Rajasthan leads with the highest installed capacity of 1,980 MW. This is mainly because the state has strong potential for both solar and wind energy. Rajasthan receives high solar irradiation and also experiences strong wind speeds, making it ideal for hybrid energy generation. The installed capacity of hybrid projects has shown a year-on-year growth of about 23.72% compared to September 2024, when it stood at 2,632.32 MW. This steady growth highlights the increasing focus on hybrid projects as a solution to improve grid stability and renewable energy utilization.

Electricity Market

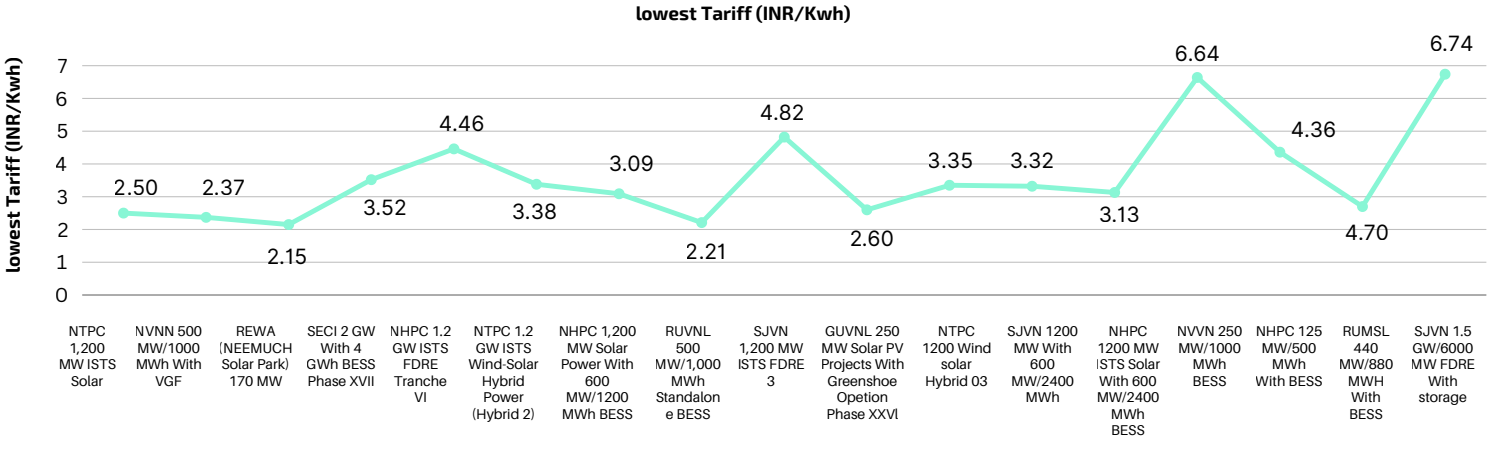
IEX ELELCTRICITY MONTHLY TRADED VOLUME IN 2024-2025



SOURCE: IEX **SOLARQUARTER RESEARCH**

In September 2025, the Indian Energy Exchange (IEX) reached a total volume of 11,370 million units (MU), a 2.7% year-over-year decline. According to government data published in September 2025, the country's energy consumption reached 145.91 BUs, representing 3.2% increase year-on-year. The Market Clearing Price in the Day Ahead Market at ₹3.58/unit during September 2025, declined 14.5% year-on-year. Similarly, the Market clearing price in the Real Time Market at ₹3.31/unit during September 2025, declined 16.8% year-on-year.

Lowest Solar Tariff (₹/kWh) in 2024 - 2025



SOURCE: SOLARQUARTER RESEARCH **BIDDING DETAILS**

The introduction of the Approved List of Models and Manufacturers (ALMM) List-I for solar PV modules, along with the upcoming ALMM List-II for PV cells effective from June 2026, has created fresh compliance challenges for developers participating in India's solar auctions. These regulatory measures, combined with persistent global supply chain disruptions triggered by geopolitical tensions such as the Russia-Ukraine war, the U.S. trade tariff conflicts, and volatile currency exchange rates, have led to noticeable fluctuations in solar tariffs.

While the Indian government has provided some relief by extending project commissioning timelines, developers continue to face mounting cost pressures. The recent imposition of anti-dumping duties on solar PV glass imports from China and Vietnam has further increased input costs, prompting domestic manufacturers to raise prices and adding financial strain to project economics. To mitigate these impacts, the government has announced GST relief on solar PV modules and components effective from September 2025. India crossed 100 GW of Solar PV Module manufacturing installed capacity.

Meanwhile, the U.S. tariff hikes on solar imports have tightened global module supply, pushing prices higher and indirectly influencing the Indian market. As a result, solar tariffs in India through 2024 have remained volatile, shaped by escalating material costs, project size, and grid connectivity constraints.

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Saatvik Green Energy Limited

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Loom Solar

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Selec Controls

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