IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

Indian Wind Power

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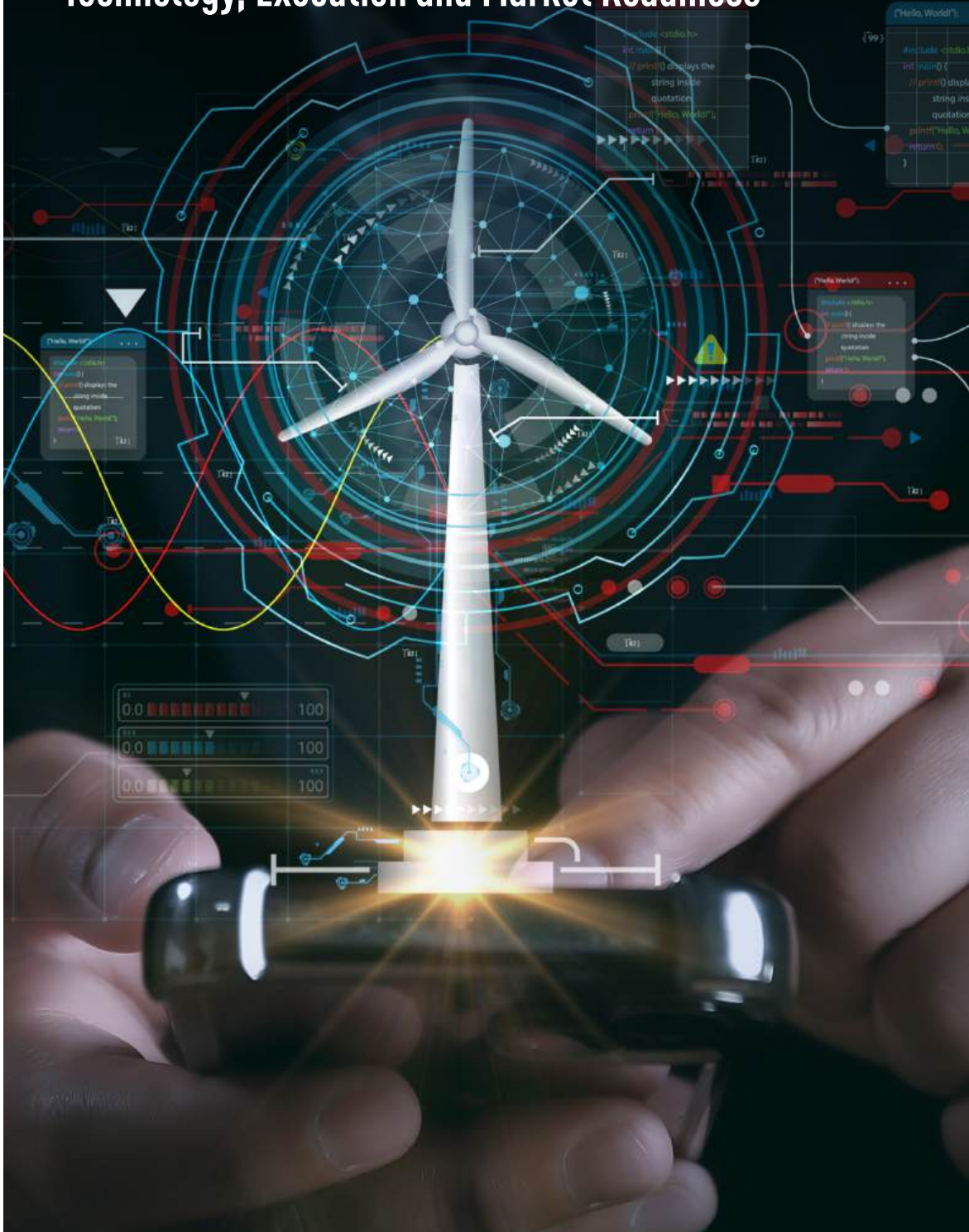
Advancing India's Wind Power Industry 2026

Technology, Execution and Market Readiness



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IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

From the CEO's Desk

Dear Readers,

As 2026 gathers pace, India's wind energy sector is entering a phase of renewed momentum, defined by larger scale, clearer policies, and growing confidence across the ecosystem. The year gone by has been exceptional: 2025 recorded the highest-ever annual wind capacity additions of about 6.3 GW, an increase of over 85% compared to 2024. With cumulative installed wind capacity touching nearly 54.5 GW by 31 December 2025, India is now firmly on course toward its 100 GW wind capacity target by 2030.

This year's Union Budget 2026–27 has further reinforced that trajectory by placing clean energy at the heart of India's growth and infrastructure push. Higher public capital expenditure, continued support for grid and storage infrastructure, and measures to strengthen domestic manufacturing through SEZ duty reliefs and tying up with National Manufacturing Mission are expected to enhance project viability and accelerate renewable energy deployment, including wind, while bolstering India's long-term energy security and net-zero 2070 vision.

IWTMA has intensified its engagement across key national and regional platforms to advance this agenda. Early in January 2026 itself, IWTMA convened a focused Rajasthan Roundtable Conference that brought together senior policymakers, utilities, and developers to deliberate on wind integration, transmission readiness, and state-level execution pathways. The Association and its members also led wind-centric deliberations at Bharat Renewable Expo 2026, ensuring that the role of wind in round-the-clock, hybrid, and resource-adequate portfolios was clearly articulated to a wider renewable energy audience.

In parallel, IWTMA has been actively contributing to the apex energy policy dialogue platforms of the country. Our participation at India Energy Week 2026 enabled the Association to spotlight "Wind and Solar Opportunities" from the vantage point of national energy strategy, ensuring that wind remains integral to discussions on affordability, reliability, and decarbonisation at the highest levels.

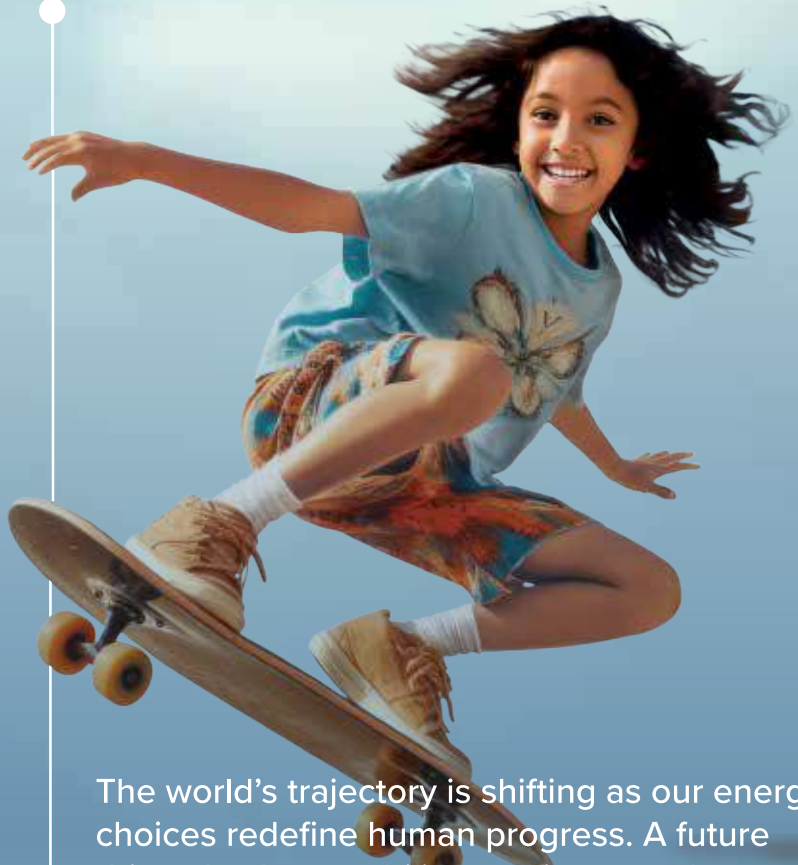
We have also maintained close and constructive engagement with the Ministry of New and Renewable Energy (MNRE). We are particularly grateful for the recent decision to constitute a dedicated Wind Projects Task Force, developed jointly with industry. This mechanism is expected to bring greater synergy and sharper focus to resolving on-ground project execution challenges spanning transmission, land, regulatory processes, and contracting. By working closely with stakeholders, we can play a pivotal role in translating committed capacity into timely commissioning on the ground.

I extend my sincere appreciation to our members for their continued trust, support, and active engagement with IWTMA's initiatives. Your investments, innovations, and on-ground execution are the true drivers of India's wind success story. As we move further into 2026, we do so with confidence, clarity, and a shared purpose: to ensure that wind energy stands at the forefront of India's journey toward a cleaner, more secure, and more resilient energy future.

With warm regards,

Aditya Pyasi
CEO, IWTMA
(Indian Wind Turbine Manufacturers Association)

Energy for the New World



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Perspectives on Scaling Wind Manufacturing with Dr. Saravanan Manickam

Country Head & Managing Director – Nordex India Pvt. Ltd, Vice Chairman-cum-Secretary, IWTMA

Nordex has committed significant new investment to expand its India facility. What strategic capabilities (volume, product mix, new platforms) will this expansion unlock for both the Indian and global markets?

In early September 2025, the Nordex Group proudly entered a ₹1,000 crore Memorandum of Understanding (MoU) with the Government of Tamil Nadu. This collaboration signifies our commitment to strengthening our presence in India, a vital manufacturing and export hub that supports our global growth objectives.

Capacity and Scale: We are committed to significantly enhancing our annual output and improving throughput efficiency in nacelle assembly and blade production. This advancement will enable us to respond more promptly to domestic demand and fulfil export orders.

Product Mix and Platforms: By localising the newer Delta4000 variants—including those designed for cold climates and high temperatures-we aim to broaden our addressable markets while effectively reducing the Levelized Cost of Energy (LCOE).

Jobs and Ecosystem: This initiative is expected to create approximately 2,500 direct employment opportunities and to generate additional positive impacts through our logistics operations and tier-2 and tier-3 suppliers in and around Tamil Nadu.

Export and Supply Chain: We view India as a cost-effective export base for markets across Asia, Africa, the Americas, and Europe. Our approach will include a balanced multi-port strategy to enhance the resilience of our logistics operations.

Make in India: We remain dedicated to increasing local value creation while closely aligning our activities with national manufacturing priorities and quality standards.

How is Nordex India aligning its strategy to support the country's transition toward larger turbine platforms and hybrid renewable systems?

We are transitioning to higher-capacity platforms to enhance energy yield globally and reduce the Levelized Cost of Energy (LCOE). Alongside this transition, we are thoughtfully incorporating hybrid and storage-ready designs to accelerate our initiatives and bring them to market more quickly in line with global demand. It's helping the country's employment, supplier development and foreign investments.

Furthermore, we are engaging constructively with the Kamarajar Port Authority regarding the potential use of their facilities as a secondary export gateway. This approach seeks to complement our existing operations through VOC Port, ultimately allowing us to optimise transit times and enhance overall reliability.

As Vice Chairman of IWTMA, what are your top three policy or

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regulatory priorities to accelerate both domestic installations and India's emergence as a wind manufacturing export powerhouse?

Domestic Value Addition & Quality: We believe that enhancing quality assurance through approved model frameworks is crucial for our development. We encourage a progressive approach to localisation and suggest that transitional duty support on critical components is provided to mitigate potential cost fluctuations. We endorse thoughtful policy measures designed to incentivise domestic supply chains while maintaining robust data governance, ensuring that ongoing projects continue without disruption.

Market Certainty & Hybrid/RTC: We propose establishing a clear trajectory for wind Renewable Purchase Obligations (RPO) through 2030, complemented by wind-solar hybrid and Round-the-Clock (RTC) tenders, which can foster predictable offtake and optimise grid utilisation.

Export Enablers: We advocate for the development of dedicated export infrastructure and logistics incentives to establish India as a preferred manufacturing hub for global Original Equipment Manufacturers (OEMs) and contract manufacturers.

What capability enhancements or future investments are essential for India to achieve 100 GW of wind by 2030?

India has made significant strides in its wind energy capacity, currently boasting approximately 54 GW of installed capacity as of late 2025. This represents a promising near doubling in just five years.

Grid and Storage: It is advisable to enhance transmission infrastructure as part of the Green Energy Corridor initiative and to expedite the development of utility-scale storage solutions, including batteries and pumped hydro, to facilitate a consistent round-the-clock (RTC) energy supply.

Repowering and Technology: We recommend gradually replacing legacy sub-2-MW wind turbines with modern 3-5-MW models. Prioritising climate-resilient designs that withstand high heat, humidity, and saline conditions will be beneficial, as will promoting integrated wind-solar hybrid systems.

Manufacturing Depth: Expanding Production-Linked Incentive (PLI)- style incentives to cover components such as gearboxes, specialised bearings, and high-strength steels may foster greater local value addition in the manufacturing sector.

Finance and Compliance: Strengthening Renewable Purchase Obligation (RPO) compliance, enhancing payment security mechanisms, and adopting a cohesive cybersecurity strategy for digital turbines and SCADA (Supervisory Control and Data Acquisition) systems would contribute to a more robust and secure energy infrastructure.

How can India strengthen its domestic supply chain to reduce import dependence for critical wind components?

India has made commendable progress in indigenisation, with estimates suggesting a level of around 70–80%. Nevertheless, there are still some challenges that need to be addressed, particularly in high-value components such as gearboxes, specialised bearings, and permanent magnet materials.

To enhance this initiative, it would be beneficial to align Original Equipment Manufacturer (OEM) eligibility with approved model lists and establish robust certification processes. Additionally, it is essential to implement localisation targets in phases, in line with the readiness of domestic capacity.

We may also consider several strategic approaches, including targeted extensions of Production- Linked Incentives (PLI), a comprehensive critical minerals strategy that focuses on diversified sourcing and recycling, and an expansion of domestic research and development/testing initiatives. Supporting these efforts with measures like accelerated depreciation or super-deductions on capital expenditures, as well as duty calibration that rewards local value addition, can help facilitate growth without constraining short-term development.

Moreover, providing tailored support for primary import components, fostering localisation in technology transfer, incentivising local investments, and considering waivers on capital expenditures can further strengthen our domestic industry.

As the wind industry enters a high-growth phase, what talent, technology and innovation drivers will define the next chapter for Nordex India?

Talent: We prioritise selective hiring for high-value roles in engineering, digital, and operations leadership. This approach is bolstered by the Compass development framework and GWO-standard training, ensuring our teams are well-equipped for success.

Technology & Platforms: We are evolving Delta4000 variants with flexible ratings and developing hybrid tower solutions to achieve higher hub heights. Additionally, we are committed to advancing digitalisation throughout the design-to-service process.

Manufacturing & Logistics: Our current initiative involves executing a ₹1,000 crore expansion in Tamil Nadu, while we are also exploring a dual-port strategy, including Kamarajar, to enhance efficiency, reduce lead times, and improve schedule reliability for our export operations.

Culture (Anecdote): During a recent visit to one of our plants, a new technician remarked, "The turbine listens to me now." This was in reference to the turbine pausing due to a storm alert. Such expressions of ownership reflect the proactive mindset that we believe will drive our next chapter in India.

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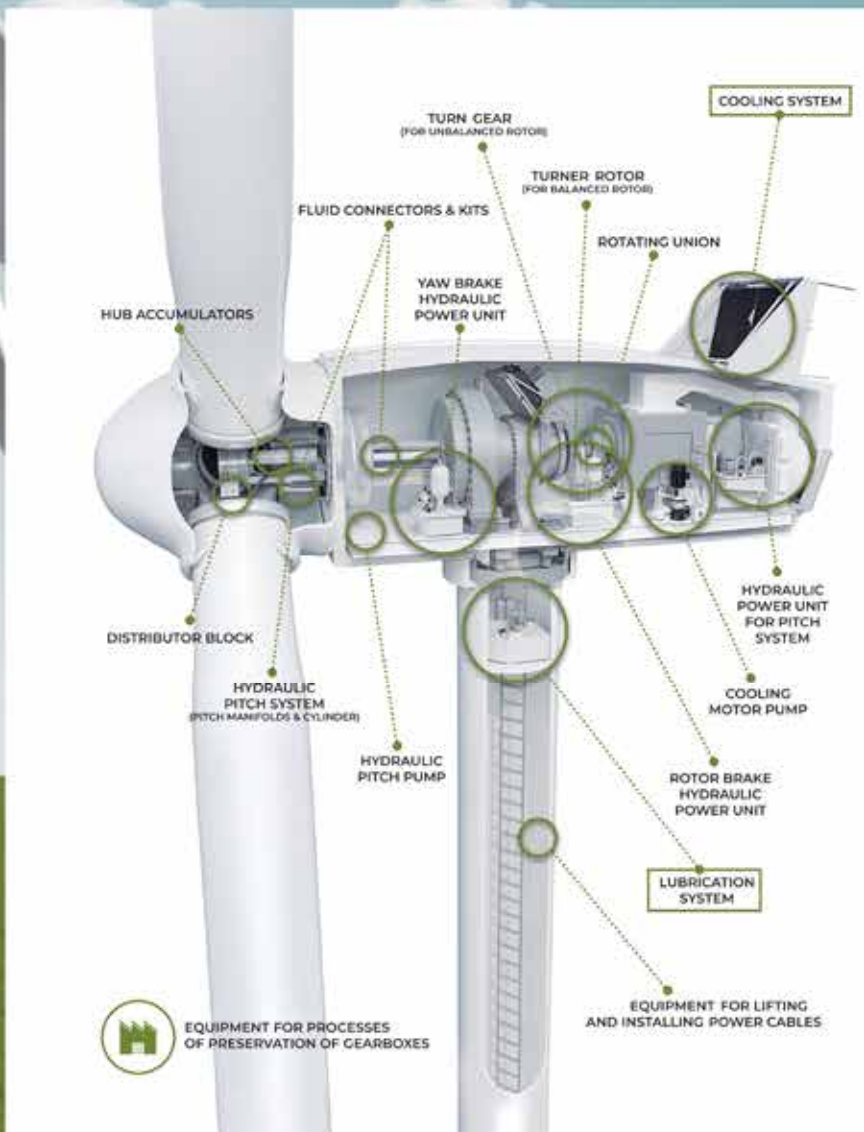

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A Conversation on Strengthening Logistics & Execution with Mr. Baskar Radhakrishnan

Managing Director - Baettr India

In the context of India's expanding wind manufacturing ecosystem, how critical is logistics and supply-chain readiness to sustaining scale, reliability and competitiveness across the sector?

India's wind manufacturing ecosystem is clearly entering a phase where scale alone is no longer sufficient, execution capability is becoming the true differentiator. While manufacturing capacity and turbine sizes have expanded rapidly, logistics and supply-chain readiness are now central to sustaining reliability and competitiveness.

What is increasingly evident is that logistics is no longer a downstream activity. It directly influences cost certainty, delivery timelines, and project risk. As component sizes grow and installation windows tighten, even small inefficiencies can cascade into major delays. Companies that integrate logistics thinking into their manufacturing and project planning are better positioned to deliver consistently.

Looking ahead, India's ability to align manufacturing excellence with robust, predictable logistics execution will be critical in reinforcing its position as a global wind manufacturing hub.

How can logistics ecosystem development around hubs such as Chennai enhance efficiency and reduce execution risk for the wind sector?

Industrial hubs like Chennai are emerging as strategic enablers for the wind sector due to their proximity to ports, manufacturing clusters, and skilled service providers. Over time, these hubs are evolving beyond location advantages into integrated logistics ecosystems.

What makes a difference is not just infrastructure, but coordination, specialized transport partners, experienced port handling, staging yards, and clear last-mile connectivity. When these elements work together, execution risks reduce significantly, and projects benefit from greater predictability.

As volumes scale and components become larger, strengthening such logistics ecosystems around key hubs will be essential to support faster execution and lower variability across the sector.

What capabilities are essential for Indian heavy component manufacturers to become globally competitive and export-ready from a logistics and supply-chain perspective?

India's heavy component manufacturers have made strong progress in scale and quality, but global competitiveness increasingly depends on logistics maturity. Export readiness today requires the ability to handle oversized cargo, interface seamlessly with ports and customs, and manage documentation and compliance with precision.

Equally important is the ability to offer predictable lead times and cost transparency to global customers. This builds confidence and positions Indian manufacturers as reliable partners, not just cost-effective suppliers.

As India deepens these capabilities, it will move decisively from being a domestic manufacturing base to a globally integrated export platform.

How does integrating logistics planning early into manufacturing and project design improve cost certainty, delivery timelines and risk management?

Early integration of logistics planning fundamentally transforms project execution. When logistics is embedded at the design stage, manufacturers can optimize component dimensions, lifting concepts, transport routes, and packaging strategies from the outset.

This proactive approach eliminates late-stage constraints, minimizes rework, and improves cost and schedule predictability. More importantly, it elevates logistics from a reactive support function to a strategic risk-management lever.

At Baettr, we work closely with OEMs and logistics partners from the earliest design phases, ensuring components are optimized for manufacturability, efficient transport, and cost competitiveness. This collaborative model reduces production bottlenecks and delivery risks while maximizing value across the end-to-end supply chain.

In an industry where margins and timelines are increasingly constrained, early logistics integration becomes a decisive enabler of predictable, scalable, and resilient execution.

How can India's ports and transport infrastructure evolve to support increasing component sizes and higher annual installation volumes?

India's wind sector is entering a phase in which infrastructure must advance in step with technology. The shift toward larger turbines and higher installation volumes is placing significantly greater demands on ports, road networks, and material-handling facilities.

By 2030, India plans to commission offshore wind projects along the coasts of Gujarat and Tamil Nadu. Achieving this ambition will require focused attention on critical priorities, including enhanced load-bearing capacities, availability of specialized heavy-lift equipment, specialized offshore commissioning and service vessels, and streamlined customs and clearance processes. Digitalization and process standardization will also be key enablers in reducing dwell times and operational uncertainty.

Sustained investment across these areas is essential to ensure that infrastructure capacity keeps pace with sector growth and does not become a constraint as the industry scales.

As Baettr expands capacity at its Tamil Nadu facility, how is the company strengthening logistics and supply-chain capabilities to support next-generation wind projects at scale in India?

As Baettr expands its capacity in Tamil Nadu, logistics and supply-chain planning remain fundamental to our growth strategy. From the outset, we ensure close alignment between manufacturing operations, logistics partners, and project schedules.

We are strengthening collaboration across the supply chain including raw material suppliers, machining partners, transporters, ports, and service providers while standardizing handling and planning processes to improve predictability and execution discipline.

In parallel, Baettr is reinforcing long-term contractual partnerships with critical suppliers, with a focus on higher volumes, optimized cost structures, and a resilient end-to-end supply chain capable of supporting global demand.

Our objective is to build a scalable and repeatable logistics model that supports both domestic and export projects today, while enabling future opportunities as turbine platforms continue to evolve.

Looking ahead, what changes in logistics and supply-chain planning will be most critical to sustaining long-term growth in India's wind manufacturing ecosystem?

Sustained growth in India's wind manufacturing ecosystem will depend on deeper, structured collaboration across the value chain. As turbine platforms grow larger and more complex, fragmented decision-making will become a significant risk. Coordinated planning, shared visibility of demand and capacity, and early stakeholder engagement will be essential to improve execution certainty and system efficiency.

Standardization will be critical in the next phase of growth. Harmonized processes across handling, transportation, packaging, and documentation will reduce variability, delays, and costs.

At the same time, sustained investment in heavy logistics infrastructure will be indispensable. As component sizes and weights continue to increase, ports, roads, yards, and handling facilities must be upgraded.

Multimodal transport solutions integrating road, rail, and sea will become increasingly important to move large components efficiently while controlling cost and environmental impact. Without these investments, infrastructure risks becoming a limiting factor rather than an enabler of growth.

With the right strategic focus, logistics has the potential to evolve from a perceived constraint into a source of competitive advantage for India. Efficient, reliable, and well-integrated logistics systems can shorten project timelines, reduce total installed costs, and improve India's attractiveness as a manufacturing and export hub.

In the long term, this integrated and forward-looking approach will allow India not only to scale its domestic wind capacity but also to strengthen its position within global wind manufacturing supply chains. By aligning infrastructure, policy, and industry capabilities, India can emerge as a resilient, cost-competitive, and reliable partner for the global energy transition.

Decentralised Wind Solutions with Mr. Dungar Singh Sodha Sankhli

Founder – Sunwind Innovative

Your early experiences in rural Rajasthan shaped a deep understanding of energy access. How did those formative years influence your vision for decentralised wind solutions in India?

I grew up in Barmer, Rajasthan, where unreliable electricity defined daily life power cuts disrupted education, agriculture, healthcare, and communication. We students improvised lighting solutions just to study after sunset; those hardships left an indelible mark.

Energy poverty, I realised early, transcends technical hurdles; it's a barrier to development. This drove my conviction that India requires decentralised, deployable solutions for grid-challenged regions. Rajasthan's wind abundance prompted the key question: why limit wind to mega-farms? Sunwind was born to deliver small wind solutions that are accessible, affordable, practical.

In the context of India's renewable energy transition, what role do you see small and distributed wind systems playing alongside utility-scale projects?

India has made remarkable progress in utility-scale renewable energy, particularly through large wind and solar parks. However, the energy transition will remain incomplete unless decentralised needs are addressed.

Globally, small wind systems are increasingly recognised as complements to rooftop solar, capturing wind energy during night-time and seasonal variations. In India, distributed wind is well suited for farms, coastal communities, border regions, islands, and industrial rooftops areas often beyond the reach of large projects.

Hybrid decentralised models, where small wind and solar work together, can deliver round-the-clock power while strengthening local energy security and resilience.

How has your field experience across rural and remote regions shaped Sunwind's approach to designing reliable and practical small wind technologies?

Sunwind's technology is firmly rooted in field realities. We did not begin with laboratory assumptions; we began with on-ground challenges.

In rural and remote regions, users require systems that are easy to install, demand minimal maintenance, and perform reliably even at low wind speeds. This led us to focus on vertical-axis small wind turbines, which operate efficiently at low RPM, generate minimal noise, and adapt well to varied terrains.

Every design decision whether related to structure, materials, or control systems emerges from direct feedback from farmers, rural entrepreneurs, and off-grid users. Our guiding principle is simple: technology must serve people, not intimidate them.

What potential do solar–wind hybrid systems hold in improving energy reliability and reducing diesel dependence in off-grid and weak-grid areas?

Diesel generators continue to dominate backup power solutions in many regions, but they impose high costs, emissions, and long-term sustainability risks.

Solar–wind hybrid systems offer a compelling alternative. While solar generation peaks during the day, wind energy often rises during evenings, nights, and monsoon seasons. Together, these systems can significantly improve reliability and, in optimised configurations, reduce diesel dependence by 80 - 90 percent.

Such hybrid solutions are ideal for agricultural pumps, cold storage, telecom infrastructure, healthcare facilities, and rural industries cutting operating costs while advancing decarbonisation.

Can you share how your MoUs and partnerships with state governments and institutions are expected to support job creation and strengthen local manufacturing?

At Sunwind, we believe energy independence must go hand in hand with industrial growth and employment generation.

Our MoUs with state governments, including a ₹400-crore agreement with the Government of Rajasthan, aim to create regional manufacturing ecosystems for small wind technology. These partnerships focus on local assembly, skill development, MSME participation, and deeper supply-chain integration.

By localising manufacturing, we reduce costs while creating sustainable employment opportunities for youth, technicians, and engineers fully aligned with national priorities such as Make in India and Atmanirbhar Bharat.

Looking ahead, how do you envision the future of small wind energy in India, and what ecosystem support would help accelerate its adoption?

I believe the coming decade will be transformative for small wind energy in India, much like the rise of rooftop solar. Small wind turbine technology will become a trusted solution, particularly in rural, coastal, and high-wind corridors.

To accelerate adoption, India needs a clear national policy framework for small wind, standardised certification norms, financial incentives including hybrid net-metering support, and greater awareness among policymakers and consumers.

With the right ecosystem in place, India can not only scale small wind domestically but also emerge as a global manufacturing and innovation hub in this segment.

Closing Quote

"Wind energy is not merely a business for me; it is a promise rooted in my upbringing in Barmer that no child studies in darkness and no village is left behind. Small wind is not the future; it is the present, waiting to be recognised."

Technology Perspectives on Scaling Higher-Capacity Wind Turbines with Mr. P R Gopan

Chief Technology Officer – Envision Energy – India & Australia Region

As India positions itself as a manufacturing and export hub for wind turbines, what technology and platform-level decisions are most critical to achieving long-term export competitiveness across global markets?

From a technology standpoint, the key contributing factor for long-term export competitiveness is primarily technological innovation (Low Levelized Cost of Energy, Operational reliability and Designed for suitability across varied climatic conditions) on platform robustness and adaptability. Designing turbine platforms that can meet diverse certification regimes and Integrating AI, Internet of Things (IoT), and digital twin technology to predict anomalies upfront and optimize performance in real-time, to deliver predictable lifecycle performance is essential. Standardised core architectures combined with modular adaptability allow platforms to be deployed across multiple markets without compromising reliability or cost efficiency. Equally important is a strong focus on quality systems, validation depth, and long-term serviceability, which collectively build confidence among global customers and financiers.

How does India-specific engineering influence long-term reliability, performance stability, and bankability as turbine capacities increase?

India-specific engineering becomes increasingly critical as turbine sizes grow, extreme climatic conditions such as High ambient temperatures, lightning strike, higher dust & humidity level and challenges due to grid variability place unique stresses on turbine systems. Designing platforms that explicitly account for these factors whether through thermal management, material selection, control strategies, or structural margins directly enhances reliability and availability. Over time, this translates into stronger bankability, as consistent performance under challenging conditions reduces operational uncertainty and strengthens investor confidence.

From a technology perspective, how do larger rotor diameters and higher power density translate into improved annual energy production and lower LCOE for wind projects?

Larger rotor diameters fundamentally change the energy capture equation by accessing a greater swept area, particularly beneficial in low-to-medium wind regimes common across many Indian sites. When combined with optimised power density and advanced control algorithms, this enables higher annual energy production without proportionally increasing structural or operational complexity. From a technology perspective, the key is achieving this balance efficiently, so gains in energy yield directly contribute to lowering LCOE while maintaining long-term structural and operational integrity.

What were the key technology and execution learnings from transporting and installing a 5 MW-class turbine under Indian logistical and site conditions?

One of the most important learnings is that technological advancement and execution planning must evolve together. As component sizes increase, logistics constraints from transport routes to crane availability become decisive factors. Early alignment between turbine design, transport engineering, and installation methodology is essential to minimise risk. The experience reinforced the value of detailed route planning, specialised handling equipment, and disciplined execution protocols, all supported by close coordination among multiple stakeholders. These learnings will be central to scaling future deployments smoothly.

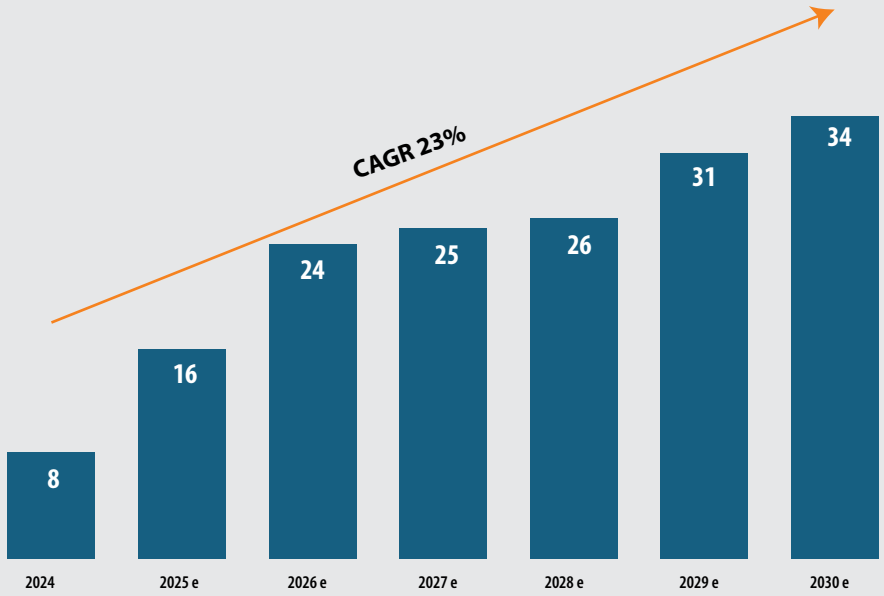
Based on recent commissioning experience, what capabilities must India's wind ecosystem strengthen to enable wider deployment of next-generation turbine platforms?

The broader ecosystem must evolve in parallel with turbine technology. This includes strengthening heavy logistics infrastructure, expanding availability of specialised installation equipment, and enhancing skill levels across installation and service teams. At the same time, closer collaboration among OEMs, developers, logistics providers, and policymakers will be critical to reduce execution uncertainty. As turbine platforms continue to scale, ecosystem readiness rather than technology alone will determine how effectively India can deploy next-generation wind systems at scale.

Charting a Course: International Offshore Wind Experiences to Help Shape the Marine Energy Vision for India

The current state of the Indian energy transformation is marked by an ambitious plan of reaching **500 GW of non-fossil fuel capacity by 2030** [1]. Though solar and onshore wind power constitute the major share of the dream of change, the country's untapped potential of offshore wind power is slowly gathering momentum as the third leg of this saga. With an extended coast of approximately 7,600 km, the country has an unparalleled potential of capacity factor-rich wind generation in the Exclusive Economic Zone (EEZ). Being a country with purposeful plans for changeover in the field of renewable energy, it's important for the industry to learn from the two decades of collective experience of pioneering nations worldwide in offshore wind energy - the United Kingdom, China, and Denmark.

New installations outlook for Offshore Wind 2025 - 2030(GW)



Source: GWEC | GLOBAL WIND REPORT 2025

The Global Blueprint: Lessons from Leading Offshore Markets

The global wind industry, specifically the offshore wind industry, has expanded exponentially, with installations over 83 GW in 18 countries as of the end of 2024 [2] and is estimated to grow at a CAGR of 23% until 2030.

The experience of the early movers provides three distinct and important lessons for India.

1) The United Kingdom: Revenue Stability and Supply Chain Resilience

The United Kingdom as a leader in the global arena, has proven the value of a stable and long-term policy support instrument with the **"Contracts for Difference (CFD)"** support scheme. The CFD offers a minimum price guarantee to the electricity producers, thus ensuring considerable private investments, resulting in the cost of offshore wind energy plummeting.

With that being said, there is also a cautionary tale here, as evidenced by the experience of the UK's 5th Allocation Round (AR5) was not successful, as there were no new offshore wind farms due to the maximum strike price offered by the government not taking into account the global inflation and supply chain costs [3]. This experience highlights an important lesson - **policy frameworks should be nimble and reactive, reflecting real-world macroeconomic changes.** There appears to be growing emphasis on supply chain resilience on the part of the UK, as "Clean Industry Bonus" initiatives now reward those companies that can promote local manufacturing and infrastructure spending, to ensure the localized benefit of the transition happening through the energy revolution.

2) China: The Power of Scale and Integrated Manufacturing

China's growth to become the world's largest offshore wind market has been fueled by rapid, large-scale deployment

and integrated domestic manufacturing. By providing strong regional support and fostering a vertically integrated supply chain, China achieved a speed and scale of development that has led to rapid cost reduction through "learning by doing" [4]. In 2024 alone, China added an estimated **4.4 GW** of offshore wind power projects [5].

The Chinese model highlights that **massive scale is the fastest route to cost competitiveness**. For India, this implies avoiding a piecemeal approach and focusing on large, contiguous development zones, such as those identified off the coasts of Gujarat and Tamil Nadu. A commitment to scale will provide a sign of confidence to global investors, developers and manufacturers, encouraging them to set up and fund local facilities and drive down the Levelized Cost of Energy (LCOE).

3) Denmark: Streamlined Planning and Social License

Being the birthplace of the commercial offshore wind industry, Denmark offers a great learning experience in terms of planning. The Danish experience is marked by the **"one-stop-shop" approach**, where the whole process of clearing the permit is taken care of by the Danish Energy Agency, right from the investigation of the land to the impact assessment. This simplifies and cuts down on the administrative complexities and costs.

Therefore, there is a strong focus on ensuring the social license to operate. Community engagement has played a major role in the success of the industry, ensuring that the interests of the local communities, whether it is fishing or views, are addressed and aligned. It is imperative to focus on a permit process that is not only efficient but also inclusive, taking cognizance of the views of the coastal communities.

Key Factors Influencing India's Offshore Wind Energy Development

The first critical step has already been initiated by the Indian Government, particularly regarding the revised strategy by the Ministry of New and Renewable Energy (MNRE) in 2023 on providing initial financial support.

A Phased Development Strategy

The renewed approach of India has been threefold in terms of models for development:

Model	Development Approach	Financial Support	Global Learning Alignment
Model A	Government-led site studies and bidding	Central Financial Assistance - VGF available	De-risking-to establish initial projects - UK CfD concept
Model B	Developer-led studies with seabed exclusivity	No Central Financial Assistance - CFA	Transition to market-driven development - China scale-up
Model C	Developer-identified sites with 'first right of refusal'	No Central Financial Assistance (CFA)	Encouragement of private sector innovation and exploration

Role of Viability Gap Funding (VGF)

The Union Cabinet, taking due cognizance of the substantial initial investment required in offshore projects, sanctioned a **Viability Gap Funding (VGF) scheme with a total outlay of INR 7,453 crore** in June 2024. The amount has been allocated carefully, with a specific allocation of **INR 6,853 crores for setting up and commissioning 1 GW of offshore wind power projects** (500 MW each along the coast of Gujarat and Tamil Nadu), which will be implemented through the Model-A development route. The modalities of this VGF are required to serve as a temporary subsidy to fill the prevailing gap between such offshore projects and a feasible acceptable tariff on each unit of electricity output. This specific aspect verifies how initial de-risking is a globally accepted best practice to successfully launch a new sector.

Infrastructure and Grid Readiness

For the Indian scenario, it doesn't suffice to transport turbines, it must also advance and come up with an impressive and robust supply chain infrastructure that supports the installation of new and larger turbines of > 15MW.

The VGF program also provides INR 600 crores in the category of upgradation of port facilities [7], where upgradation is the need of the hour. The logistics involved in handling and erecting giant turbine components are demanding and need specialized port handling facilities. Without this, the whole chain would remain bottlenecked and reliant on imports. Moreover, the high-capacity factor associated with offshore power plants, that is, between 40-50% compared to onshore power generation, has many advantages in terms of grid dynamics. Therefore, implementing large scale offshore power generation involves a lot of investment in offshore and onshore transmissions.

Conclusion

The fact that India now has strong intentions to tap into offshore wind is an affirmation of its dedication to a cleaner energy future. By applying the collective lessons that have been gained from around the world in a strategic and nuanced manner and tailored for our context, India can accelerate its development activity. Leveraging the phased approach mentioned above, starting with the subsidized Model A to build the ecosystem and gradually moving to the market-driven Models B and C, will be key for this push from a logical standpoint. However, the lukewarm response to initial tenders indicates that the transition needs to be undertaken in steps to ensure that long-term revenue certainty beyond the initial VGF projects is well conveyed to developers. The VGF assistance represents the fuel on the fire, while an adaptive and futuristic policy trajectory, coupled with the commitment to volume, would likely be the wind in India's sails.

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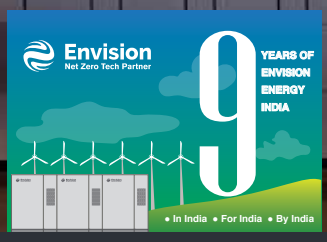

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Recent Engineering Improvements to Wind Turbine Blades

Authors - Dr. Raj Shah, Petrit Sheshori, and Mathew Roshan

Abstract:

As the global demand for renewable energy grows, engineers have focused more attention on improving blade technology on wind turbines. This is due to the fact that traditional blades have struggled with problems that include durability, efficiency, and environmental impact. This paper highlights advancements that have made blades stronger, more efficient, and safer for wildlife. One of those improvements the paper highlights is in blade materials, such as carbon-fiber composites and recyclable resins, which make the blades more durable, lighter, efficient and cost effective. The paper also covers aerodynamic design improvements such as flatback airfoils, bend-twisting coupling, and serrated trailing edges. In addition to all of this, modern sensor systems, digital twins, and active pitch control technologies allow the blades to adapt based on what the real time weather conditions are saying, allowing the turbine to operate with greater efficiency and stability. Finally, the paper examines all the wildlife friendly designs that have been made like the one black method, UV patterned tips which protect birds from colliding with the blades in the turbine. All these advancements to the turbine blades have made turbines more cost effective, environmentally friendly, and an efficient source of renewable energy.

Introduction

As demand around the world increases for renewable energy, engineers have begun to pay more attention to wind turbines and improving their technology, specifically the design of turbine blades. Since 2021 there have been major advancements to blade technology, like advances in materials, aerodynamics, and sensor systems. These innovations allow the blades to capture more wind and reduce friction and minimize the harm it creates to wildlife. As a result of these advancements wind turbines today have become more efficient, cost effective and environmentally friendly than ever before. This paper investigates the specific engineering improvements that allow modern wind turbines to produce a higher power output, last longer under worse conditions, create fewer environmental problems, and require less maintenance.

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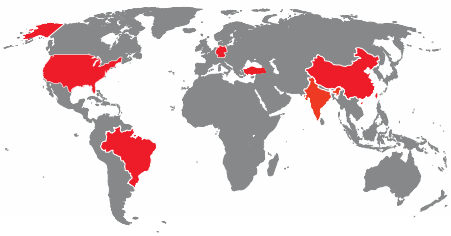

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These advancements to the blades have ultimately made modern turbines into systems that operate more efficiently, safely, and durably compared to their traditional designs.

Advances in Blade Materials

Over the past few years, the biggest advancement made to wind turbine blades is in the materials used. One of the changes to the materials is that modern blades are increasingly using carbon-fiber composites instead of the traditional fiber glass because the carbon-fiber composites have a much higher stiffness to weight ratio [1]. This allows the blade to be much longer, lighter and structurally stronger, while also reducing the bending, deformation, and mechanical stress on the entire turbine [1]. This means the turbine can produce more energy, have a longer lifetime, and operate more efficiently [1]. According to the US Department of Energy, carbon-fiber composites can reduce the blade weight by up to 25% [1]. This allows manufacturers to make the blade longer, while also making the blade easier to transport [1]. This shift to carbon-fiber composites has accelerated fast. A 2025 composites industry report said that carbon-fiber demand in wind turbines is one of the fastest growing markets as in 2020 the composites market was close to 9 billion dollars and as of 2025 it is all the way up to 15 billion dollars [2].

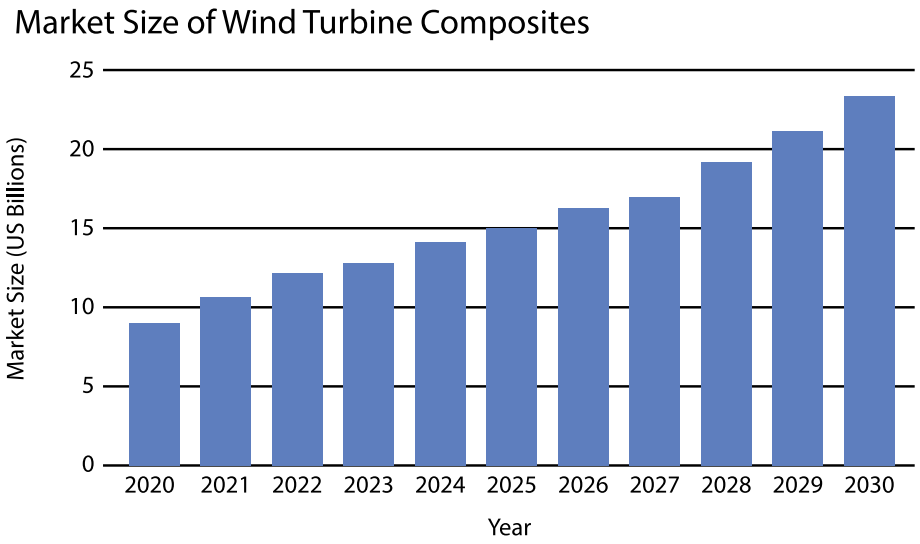

Figure 1 shows how the carbon-fiber composites market is continuing to grow and become increasingly popular throughout the years, as it is increasing by close to 8.6% from year to year. The improvement in materials has directly translated into higher energy products. One example of this is Siemens Gamesa newest turbine, the SG-236 DD [3]. This turbine uses 115-meter blades that are built with advanced composites, so it ends up achieving a 236 meter-rotor [3]. This gives it a swept area of 43,500 m2 [3].

Figure 1: Prediction of the market size for Wind Turbine Composites [2].

Turbine Model	Blade Length (m)	Rotor Diameter (m)	Swept Area (m2)	Percent Increase
SG-239 DD	115	235	43,500	33%
11-MW Fiberglass	100	200	33,000	

Figure 2: Comparing carbon-fiber vs fiberglass blades [3].

As shown in Figure 2, the turbine made with carbon-fiber composites have a significantly longer blade length, rotor diameter and swept area. These increases show how much of an improvement of carbon-fiber composites are compared to fiberglass. Besides the performance, the sustainability of the blades has improved with the introduction of thermoplastics resins like Arkema Elium. The Zebra Project showed that the first completely recyclable 62-meter thermoplastic works without reducing the efficiency or performance of wind turbines [4]. The benefit of using thermoplastic resins is that it makes the blade easier and cheaper to repair, and it allows the blades to be manufactured easier and made more consistent [4]. These advancements show that the new material science improvements have allowed the modern blade to create more energy while lasting longer.

Aerodynamic Design Improvements

Recent advances in aerodynamic designs of the blades have improved energy output and reduced drag losses. This is due to innovations like flatback airfoils, bend-twisting coupling and serrated trailing edges [5]. One aerodynamic improvement is designing thinner blades [5]. Having a thinner blade profile leads to less surface drag and allows the airflow to stay smoother along the blade [5]. By letting the airflow stay smoother along the blade it increases the overall efficiency and power production of the wind turbine [5]. Researchers have also shown that the newer wind turbine blades use flatback airfoils, as shown in Figure

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3, which are airfoils with a trailing edge [6]. They use flatback airfoils because it strikes a better balance between aerodynamic lifts and structural demands [6]. For example, the airfoils give a higher maximum lift coefficient, and beneficial lift to drag ratios [6]. Computational studies show that flatback airfoils reduce the drag-coefficient by 34% while also improving the structural stiffness of the blade [6].

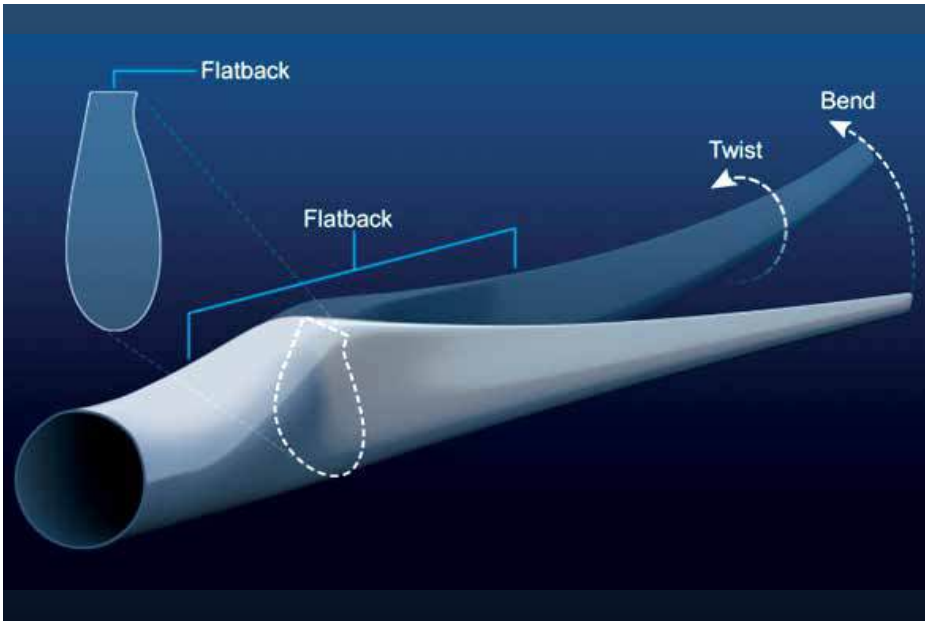

Figure 3: Example of a bend-twist-coupled blade with flatback airfoils to reduce wear and allow for longer blades without increasing weight or cost [5].

Another improvement to the designs has been with serrated trailing edges on the blades. The serrated trailing edge helps mitigate tip vortex formation, which is why there is a lot of induced drag and turbulent wake [7]. A 2023 study by Khaoula Qaissi showed that trailing edge serrations help delay the flow separation and reduce drag [7]. The study also showed that turbines with serrated blades generate more torque and increased annual energy output in lower wind speed compared to the traditional smooth-edged blades [7]. All these improvements in aerodynamics design of the blades have improved efficiency and reduced the drag of wind turbines.

Improvements in Smart Blade and Sensor Technology

Over the last few years one of the most important advancements has been in the improvement of smart blades that use sensors and digital tools to monitor wind turbines and the blades' performance. Modern blades now include pressure sensors and vibration monitors that are placed on the turbine blades [8]. These sensors track how much of the blade is bending, how strong the wind forces are, and whether there are any unusual vibrations [8]. The information from the sensors is then sent to a digital twin, which is a computer that tracks all the data from the turbine [8]. A 2024 study by Tiantan Xu said that the digital twin systems allow the operators to predict the mechanical problems earlier, which ends up reducing unplanned down time and makes maintenance more efficient [8]. Smart technology also improves how well the turbines capture wind. For example, modern turbines are using active pitch control, which means that each blade can automatically adjust its angle of attack to capture the wind more efficiently based on the weather conditions [9]. The 2024 study led by Bairen An found that active pitch control can reduce fatigue by 15-20%, meaning that the turbine can operate safer and longer [9]. All of these improvements have led to wind turbines being more efficient in the amount of energy being produced and more cost-effective.

Wildlife Safety Improvements

Environmental engineers and researchers have been focusing on making wind turbine blades safer for wildlife, especially birds. This has led to several designs and strategies. One of the most effective strategies is the one black method. This method is when engineers paint one rotor blade black to interrupt the motion smear which makes the blades invisible to wildlife [10]. A field study at Smola Wind Farms in Norway reported that there was a 72% reduction in bird deaths that had painted blades compared to unpainted blades [10]. This shows that the black paint made the blades visible when they were spun fast. Another design that was made was to include UV patterned blade tips that most bird species can detect easily [11]. Wind farms are combining colored blade tips with AI detection systems that can slow down or stop the turbine when flocks of birds are flying nearby [11]. These innovations are making it a lot safer for wildlife when they are near wind turbines.

Conclusion

Overall, the advancements made to wind turbines in materials, sensor systems, aerodynamics, and wild-life friendly systems have made wind turbines more efficient, durable, cost effective and environmentally friendly than ever before. The stronger carbon-fiber composites and recyclable resins improved how durable the blades have become, the aerodynamics improvements and smart blade sensor technology improved how much more energy the blades can capture, and all the improvements to wildlife safety have made wind turbines less of a threat to birds. All of these innovations to the blades show how wind turbines have become one of the most popular sources of sustainable energy.

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Windergy 2026: Powering the Transformation

Windergy India returns for its 8th edition in 2026, building on the resounding success of the previous show. Windergy India 2025 hosted over 350 national and international exhibitors, welcoming more than 15,000 industry professionals and reaffirming its position as India's most focused platform for driving innovation and dialogue in support of India's renewable energy goals.

Industry Insight

India's wind power sector is gaining strong momentum, with over 386 MW added in November 2025 alone, taking cumulative capacity to nearly 54 GW and reinforcing progress toward the 500 GW non-fossil fuel target by 2030. With vast onshore and offshore potential, and key hubs such as Gujarat, Tamil Nadu, and Rajasthan & Karnataka, India ranks among the world's most promising wind markets. Manufacturing nearly 80% of wind turbine components domestically, the country has built a resilient, export-ready ecosystem supported by a strong MSME base. Propelled by progressive policies and surging demand, wind power stands at the heart of India's clean energy transition. Windergy India provides a strategic platform to engage with this dynamic market, foster collaboration, and unlock long-term growth opportunities.

Windergy India 2026, scheduled to be held at the Chennai Trade Centre from October 7 to 9, will unite the architects of India's energy future. This landmark event serves as a prestigious convergence for manufacturers, investors, and visionaries to align their efforts toward the nation's net-zero goals. Beyond the exhibition floor, it offers a curated showcase of knowledge, technical expertise, and strategic insight shaping the next era of clean power.

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Windergy India 2026 returns as the definitive marketplace for wind energy, building on the strong momentum of its 2025 edition. The 2026 exhibition is poised to scale new heights, anticipating an increased international participation, a stronger technology showcase, and an even larger visitor turnout from across the global wind value chain. The exhibition will spotlight cutting-edge turbines, components, digital solutions, offshore innovations, and manufacturing capabilities that are shaping the future of clean power.

Conference

The Conference serves as the intellectual hub, addressing the critical challenges and emerging opportunities within the sector. Through a curated program of keynote addresses, expert panels, and policy dialogues, it unites academia, industry, and government to explore the innovations defining the future of wind energy.

Serving as a premier networking forum, the conference enables meaningful engagement with policymakers, regulators, investors, and technology providers, fostering collaboration, knowledge exchange, and strategic partnerships to accelerate wind energy growth in India and worldwide.

Opportunity Calling

Participating in or visiting **Windergy India 2026** offers a unique opportunity to be at the forefront of India's clean energy transformation. As the nation accelerates its shift toward renewable power, Windergy India brings together the changemakers shaping wind energy as a mainstream, reliable, and scalable energy source.

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Regulatory Updates on Wind Power

Compiled by Mr. Om Taneja, Renewable Energy Consultant

11.12.2025_Notice regarding Delay in Installation of SCADA based remote control system at IAF airfields

MNRE has issued a Notice regarding Delay in Installation of SCADA based remote control system at IAF airfields.

MoD while issuing NOCs for Wind/Solar Power Projects, stipulates a condition that the WTGs affect the performance of Air Defence Radars by generating Doppler signatures resembling actual aircraft, thereby creating spurious plots/tracks, they be switched off during war/contingencies/ for operational activities, as and when required by IAF. Towards this, the applicant needs to ensure installation of SCADA based remote control system at all earmarked IAF stations with facilities to switch off the WTGs.

Even after several reminders given during various meetings highlighting the seriousness of the issue, the required work order for implementation of the SCADA system for wind power projects are yet to be placed. It is requested to take immediate action for implementation of the system and submit an implementation schedule to this ministry at the earliest. Non submission of implementation schedule and inaction towards this issue may lead to revocation of the MoD NoC issued for the same.

https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2025/12/20251212309453435.pdf

24.12.2025_Guidelines for Virtual Power Purchase Agreements

A Virtual Power Purchase Agreement (VPPA) is a bilateral, over-the-counter (OTC) financial contract between a Renewable Energy Generating Station (REGS) and a Consumer or Designated Consumer, enabling Renewable Purchase Obligation (RPO) / Renewable Consumption Obligation (RCO) compliance without physical delivery of power.

Under a VPPA, electricity generated by the REGS is sold through authorised market mechanisms under the Electricity Act, 2003 or the Power Market Regulations, 2021. Such physical power sales are not eligible for RPO/RCO compliance. Instead, the Renewable Energy Certificates (RECs) corresponding to the contracted capacity are transferred directly to the Consumer or Designated Consumer and are non-tradable and non-transferable.

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VPPAs are executed at a mutually agreed strike price, with bilateral financial settlement of the difference between the strike price and the applicable settlement price. The minimum contract duration is one year. REGS must be registered under the CERC REC Regulations, 2022, and must submit an undertaking to the REC Registry to prevent double counting of capacity.

RECs in excess of annual RPO/RCO requirements may be carried forward, while certificates used for compliance are extinguished by the Central Agency. Contractual obligations continue for the full VPPA term, including in cases of ownership change, as per applicable laws.

Overall, the VPPA framework provides a flexible, market-aligned compliance mechanism that supports renewable capacity addition, offers price-risk hedging to consumers, and preserves regulatory and environmental integrity through strict accounting safeguards.

https://cercind.gov.in/regulations/Guidelines-VPPA.pdf

Gujarat Integrated Renewable Energy Policy-2025

Gujarat has issued Gujarat Integrated Renewable Energy Policy – 2025 to attain energy independence, affordable and reliable renewable power, foster inclusive socio-economic growth, accelerate decarbonisation, and contribute towards National Energy Transition with Mission of Gujarat as a Green Energy Leader by achieving 100 GW+ of Renewable Energy capacity, contributing significantly to India's 500 GW target by 2030.

Objectives:

a) Achieve more than 50% of total energy consumption from non-fossil fuel energy resources by 2030.

b) Achieve an installed Renewable Energy capacity of more than 150 GW by 2035, coinciding with Gujarat's 75th year of Statehood, reinforcing the State's leadership in India's clean energy transition.

c) Achieve an installed Renewable Energy capacity of 300 GW by 2047, to mark the centenary of India's independence and establish Gujarat as a frontrunner in the global clean energy landscape.

d) Lower the carbon intensity of the State economy by more than 45% by 2030 (from 2005 levels).

e) Significantly contribute to achieving India's Net Zero emission target by 2070.

Relaxation in RE Project Commissioning:

- Extended commissioning period for RE projects for Captive / Third party.
- Evacuation line timelines linked to voltage level, instead of project capacity.
- Additional six months each allowed for project and evacuation line commissioning upon payment of GERC-determined charges.

Supportive Framework for Wind Repowering & Refurbishment:

- Alignment with National Repowering Policy.
- Refurbishment/repowering allowed without dismantling old WTGs.
- Repowering timeline extended to 24 months.
- WTGs completed 25 years mandatory registration with SNA within six months from issuance of policy.
- **Incentives include:**

1. Extension of existing PPA during repowering period (max 2 years)
2. Waiver of transmission charges on unutilized capacity during changeover.
3. Priority in connectivity enhancement required for repowering.
4. Flexibility in micro-siting norms. On-Demand RE

Connectivity & Grid Strengthening:

- RE connectivity on demand via Akshay-Urja-Setu Portal.
- New transmission schemes to harness RE potential in RE-rich zones.

Policy Continuity & Ownership:

- Transfer of ownership allowed for RE projects under all previous policies.
- Projects sanctioned under RE Policy 2023 permitted to complete within their agreement timeline or 6 months, whichever is later.

Boosting Circular Economy:

- Promotion of RE manufacturing and recycling of solar, wind and storage equipment.
- Circular economy principles integrated into Gujarat's energy transition.

Private Sector & Innovation:

- Promotion of private developers for RE Parks. · Private participation in Wind Resource Assessment (WRA) and AWS installations with transparent registry.
- Prototype wind projects eligible for connectivity and allow project transfer after inclusion in ALMM (Wind).
- Incentives for Start-ups in the RE sector.

Other Provisions:

- Non-obligated entities allowed to avail RE attributes.
- DISCOMs may allow wheeling agreements at prevailing tariff order of GERC for balance project life (up to 25 years) subject to extension by GEDA & GETCO.
- Green jobs & skilling initiatives integrated into policy.

This Policy will come into effect from the date of notification and shall remain in operation up to 31st December 2030 or till notification of the new Policy, whichever is earlier.

Other Notifications:

A. 11.12.2025_Central Transmission Utility of India Limited
Draft Procedure for Approval of Change in Renewable Energy Source(s) for Projects with Granted Connectivity'

https://ctuil.in/uploads/assets/176545340937Approval%20of%20Change%20in%20Renewable%20Energy.pdf

B. 02.01.2026_ Ministry of Power.
Seeking comments on draft amendments proposed in Rule Requirements of Captive Generating Plant) of Electricity Rules, 2005.

https://powermin.gov.in/sites/default/files/webform/notices/MoPs_letter_dated_2nd_January_2026_for_stakeholder_consulation.pdf

C. 08.12.2025_CERC
Suo-motu order for Removal of Difficulties in giving effect to certain provisions of CERC Connectivity and General Network Access to the inter-State Transmission System) Regulations, 2022

https://cercind.gov.in/2025/orders/14-SM-2025.pdf

D. 12.12.2025_CEA
Submission of information regarding identified critical items those are currently being imported and support required for their localisation

https://cea.nic.in/wp-content/uploads/notification/2025/12/12_12_2025_identified_critical_items_currently_being_imported_and_support_required_for_their_localization.pdf

E. 12.01.2026 MNRE
Time-extension in Scheduled Commissioning Date of Renewable Energy (RE)Power Projects due to delay in grant of approval under Section 68 of the Electricity Act, 2003, for overhead laying of power transmission line, on account of pendency of Final Judgement by Hon'ble Supreme Court in W.P.(C) 838/2019.

https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2026/01/20260112484536424.pdf

16.01.2026_15.12.2025_MNRE
Amendments in the Supplementary Guidelines for payment of compensation in regard to Right of Way (RoW) for transmission lines issued by MoP on 21.03.2025

https://powermin.gov.in/sites/default/files/webform/notices/Amendments_in_the_Supplementary_Guidelines_for_payment_of_compensation_lines_issued_by_MoP.pdf

India News

India's Wind Capacity Reaches 54.51 GW in 2025: MNRE

India added 6.34 GW of wind power capacity in calendar year 2025, taking the country's cumulative installed wind capacity to 54.51 GW, Union Minister for New and Renewable Energy Pralhad Joshi said on 7 January 2026. Capacity additions in 2025 were about 85.38% higher than the 3.42 GW installed in 2024, reflecting a sharp acceleration in deployment. The total installed base is now 13.2% higher year-on-year, underscoring renewed momentum in India's wind sector.

Source: The Hindu | Jan 2026

Gujarat Policy Supports Repowering and Hybridisation under Integrated RE Strategy

Gujarat's new Integrated Renewable Energy Policy 2025 includes provisions to support repowering and refurbishment of existing projects, alongside promotion of hybrid and storage-linked renewable projects, reinforcing the state's leadership in clean energy deployment.

Source: Times Of India | Dec 2025

India Sets Record Renewable Energy Capacity Additions in 2025

India added a *record 44.51 GW* of renewable energy capacity by November 2025, nearly doubling the additions seen in the same period last year. This growth was led by solar energy, with 34.98 GW commissioned, while wind capacity additions reached 5.82 GW, lifting total wind installations to 53.99 GW. The nation's total installed renewable capacity stood at 253.96 GW as of November 2025, supported by strong deployment across solar and wind segments.

Source: The Hans India | Dec 2025

India Reclaims Title as World's Third-Largest Wind Market in 2025

India reclaimed its position as the third-largest wind market globally in 2025, behind China and the United States, according to Mercom India citing BloombergNEF. The country is forecast to add 6.2 GW of wind capacity this year, nearly double that of 2024, and had already commissioned 5.8 GW of new wind projects by November 2025, surpassing the previous annual record of 4.2 GW set in 2017. India's rise overtakes Brazil and Germany, marking its strongest market ranking since 2019.

Source: Mercom India | Dec 2025

India to Launch Offshore Wind Tender for Tamil Nadu Coast by February 2026

The Union Ministry of New and Renewable Energy (MNRE) has confirmed that India's first offshore wind power tender off the Tamil Nadu coast is likely to be issued by February 2026, following the completion of an ongoing wind resource assessment. Preliminary data from a floating LiDAR survey by the National Institute of Wind Energy (NIWE) shows a high capacity utilisation factor (CUF) of 45–50%, indicating strong wind potential in the region. MNRE Secretary Santosh Kumar Sarangi said the survey results have been encouraging and that the tender is expected to be finalised by May - June 2026. The government has also launched a Viability Gap Funding (VGF) scheme to support offshore wind deployment, targeting 1 GW in the first phase split between Tamil Nadu and Gujarat to kick-start projects.

Source: Times Of India | Dec 2025

International News

U.S. Government Orders 90-Day Pause on Major Offshore Wind Projects

The U.S. Department of the Interior has ordered a 90-day suspension of construction and leases for five major offshore wind farms along the East Coast including *Vineyard Wind, Revolution Wind, Coastal Virginia Offshore Wind, Sunrise Wind and Empire Wind* on the basis of cited national security concerns related to radar interference and classified risk assessments. The pause could be extended and has sparked legal challenges from developers, including Dominion Energy Virginia, which argues the action is "arbitrary and capricious." Democratic governors of New York, Connecticut, Massachusetts and Rhode Island have publicly urged the administration to lift the freeze, saying the projects had already cleared national security and environmental reviews.

Source: Recharge News | Dec 2025

Global Wind Industry Suffers Historic Downturn in 2025 Despite Chinese Resilience

The global wind industry recorded one of its weakest growth years in over two decades in 2025, with electricity generation growth slowing to about 7%, well below historical averages. Policy uncertainty, delayed projects and weaker performance in Europe and North America contributed to the downturn. China remained the key exception, sustaining strong wind capacity additions and expanding its share of global wind production.

Source: Energy News | Dec 2025

Global Wind Installations Forecast at 160 GW in 2026

Global wind power installations are expected to reach about 160 GW in 2026, marking a 6% decline from record capacity additions forecast for 2025, according to Wood Mackenzie. While most regions are projected to see year-on-year growth, China is expected to record a slowdown following the conclusion of its 14th Five-Year Plan. Wood Mackenzie noted that policy uncertainty, auction timelines and delivery risks, particularly in offshore wind, could dampen pipeline growth and developer appetite beyond 2026.

Source: The Asian Business Review | Jan 2026

Gurit Secures Long-Term Agreement with Leading Wind OEM for Supply of OptiCore Kits

Gurit has secured a five-year supply agreement worth approximately CHF 250 million with a leading global wind turbine OEM, becoming its core kit design partner under the OptiCore platform. Gurit states OptiCore optimizes core usage to reduce blade weight, resin consumption and costs, while strengthening structural integrity and supply-chain integration. The agreement reinforces customer trust in Gurit's OptiCore platform and its three-decade leadership in engineered core solutions for wind energy.

Source: Gurit Corporate Announcement | Jan 2026

Winds of Change:
Curbing Curtailment

Authors: Anson Sando and Faheera S

Introduction

India has emerged as a global leader in wind energy with early adoption, wind rich sites, and new strides in offshore development. The country is making significant progress in both capacity addition and infrastructure, ranking 4th in the world currently for installed wind capacity. The country is now well and truly in its energy transition journey, achieving over 50% of its installed electricity capacity from non-fossil fuel sources in July 2025. As of 2025, wind energy capacity crossed the 54 GW mark, contributing significantly to the national total non-fossil capacity of approximately 266 GW.

However, the rapid addition of capacity is outpacing the expansion of the transmission grid. While India aims for 500 GW of non-fossil fuel-based energy by 2030, including a wind target of 140 GW, the "must-run" status of renewable plants is frequently being compromised by grid instability and inadequate infrastructure - a growing share of India's wind energy never reaches consumers. The loss does not stem from weak generation potential, but from a grid that is increasingly unable to absorb clean power when it is produced.

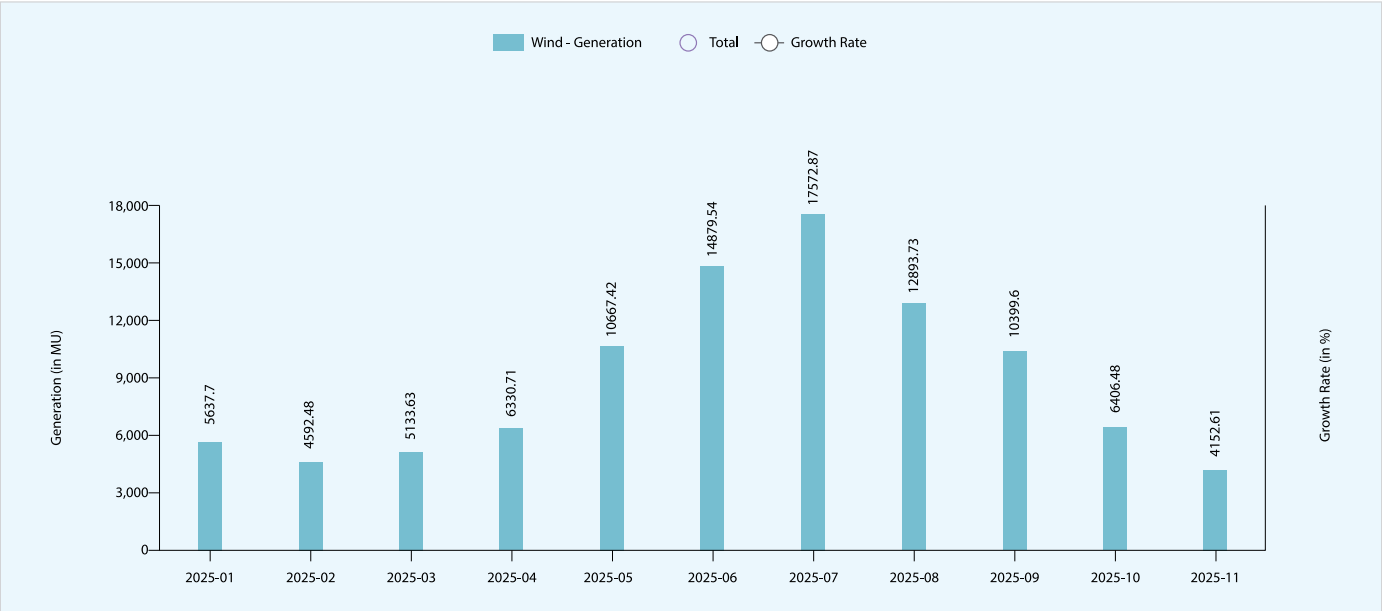
Dissecting High Generation and Energy Wastage

Wind energy in India is highly seasonal, with **70% of annual generation** occurring during the five months of the Southwest monsoon between May to September, especially during June, July and August. During these peaks, generation often exceeds local demand or the thermal-dominated grid's absorption limit. This seasonal concentration creates a recurring mismatch between supply and demand.

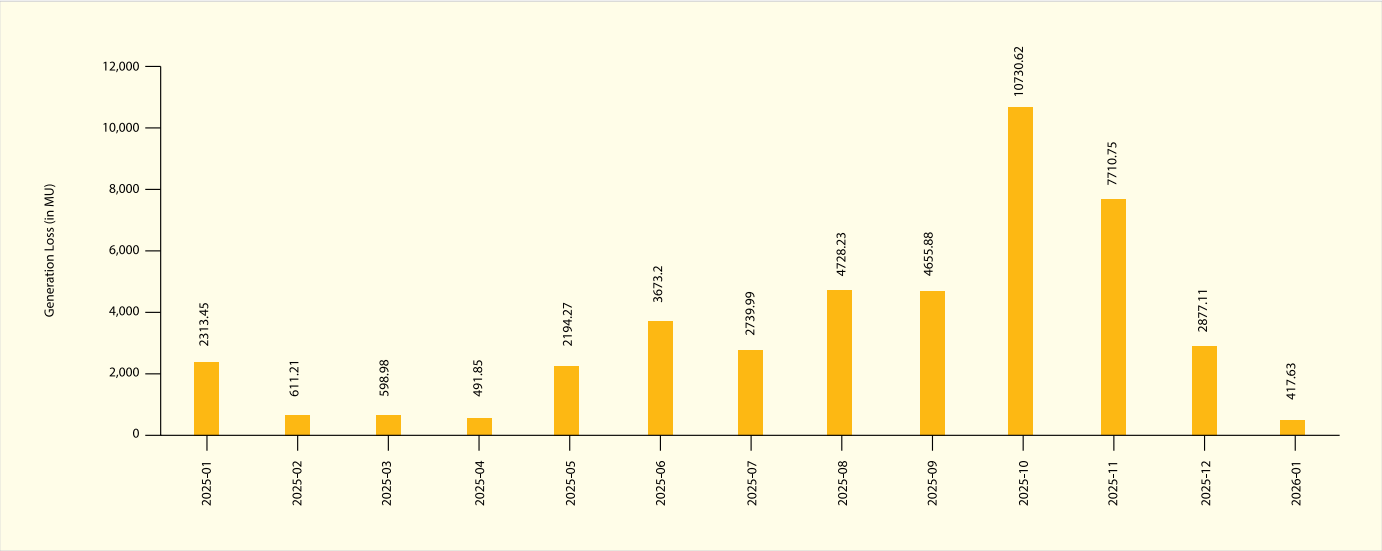
Transmission corridors connecting renewable-rich zones to load centres have not expanded at the same pace as turbine installations, resulting in repeated curtailments during peak wind hours.

- **National Impact:** Between March and August 2025, at least 30 solar and wind plants across India faced curtailment, with some developers reporting instructions to cut output by up to **48% of daily production**[2].

- The forced outages due to **'No demand/ Reserve side shutdown'** based on Niti Aayog's report follows a pattern similar to the Wind energy generation curve. The close alignment suggests that a significant portion of these outages is due to renewable energy-related curtailment. **August – November 2025** contributes to **20–34%** of total outages due to *demand/ reserve shutdown.*



India's annual wind energy generation 2025 [1]



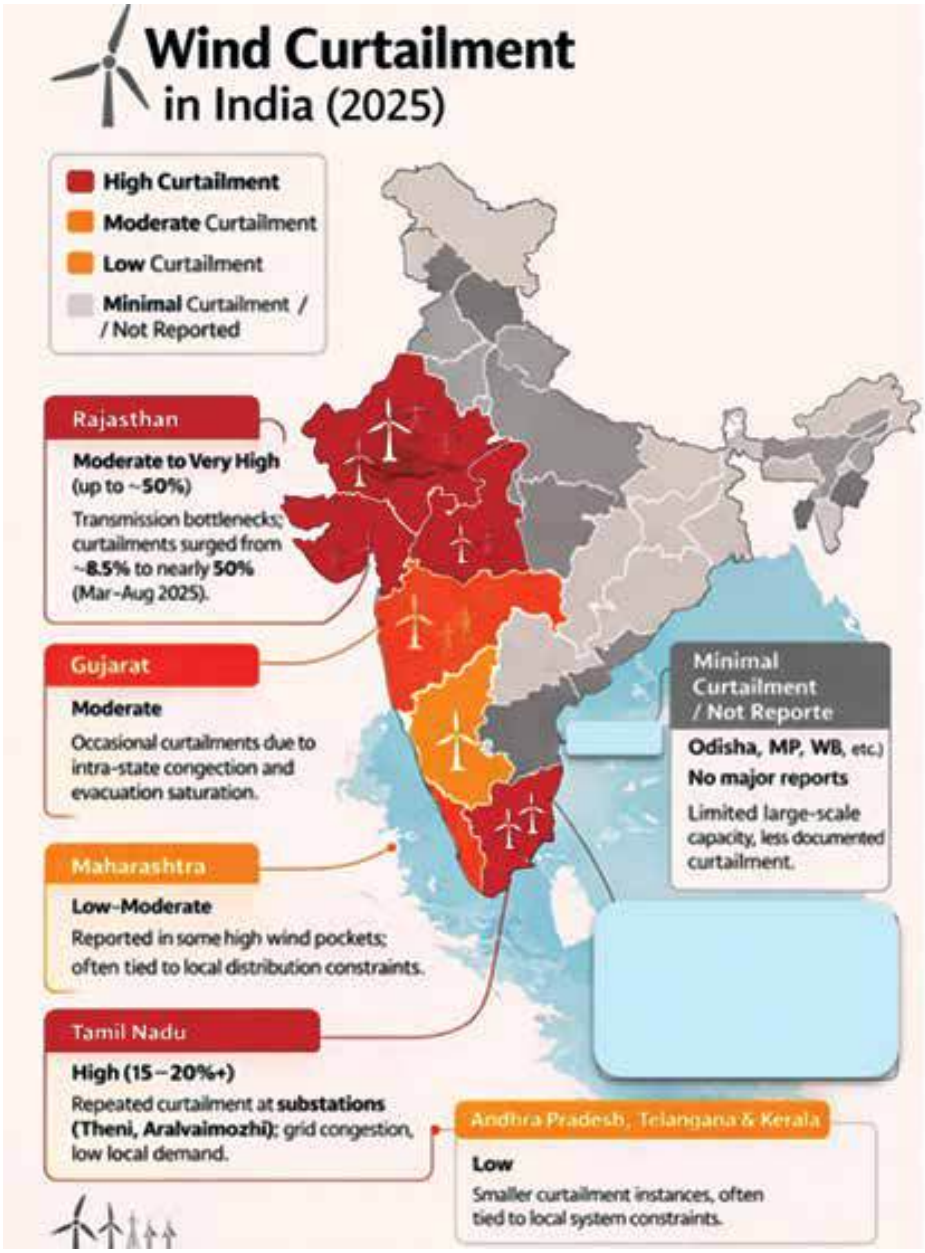
India's annual forced power outage 2025[3]

The Cost of Curtailment

Curtailment imposes costs that extend beyond lost electricity units, including revenue, increased levelized cost of energy (LCOE), stranded assets, and reduced investor confidence. We estimate the economic impact of wind energy curtailment using reported generation losses across key wind-producing states:

State	Curtailment Level	Details	Approximate Loss Estimation
Rajasthan	Moderate → *Very High*	Curtailment ~8.5% in March → ~51.5% by Aug 2025 due to transmission delays and low demand; nearly 4 GW capacity curtailed.	₹ **230 - 360 Cr** in lost revenue reported (up to ~20–25% revenue loss for developers)
Tamil Nadu	Moderate–High *(grid congestion)*	~70 million units (MU) wasted over a week due to curtailment; 8 –10 MU/day curtailment reported.	₹ **15 - 25 Cr/week** (based on ~70 MU @ ₹ 3 - 4/unit) ₹**75 - 100 Cr/month** rough estimate during peak curtailment weeks.
Gujarat	Moderate *(10–30% reported)*	Reports note curtailment within 10–30% range due to transmission issues and oversupply, similar to Rajasthan/Maharashtra contexts. (Mercomindia.com)	₹ **10 - 40 Cr/month** (varies by actual generation & curtailment levels).
Maharashtra	Low–Moderate	Curtailment noted in some high RE output periods (10–15%). (Mercomindia.com)	₹ **5 - 20 Cr/month** (approximate estimate).
Karnataka	Low–Moderate	Reported curtailment tied to grid limitations during high output peaks - lower magnitude than Rajasthan/TN (industry context). (GKToday)	₹ **5 - 15 Cr/month** (approximate).

The economic impact of wind energy curtailment is not evenly distributed across the country. It is strongly shaped by the geographic concentration of wind capacity in a small number of states, where generation peaks are misaligned with major demand centres.



India's wind energy curtailment 2025

For developers, curtailed energy continues to carry financing costs. Loan repayments, land leases, and operations and maintenance expenses persist regardless of dispatch, affecting the cost per delivered unit of wind power.

Way Forward: The long and short of flexibility and responsiveness

To bridge the gap between generation peaks and demand troughs, India is increasingly moving towards adding flexibility in the form of energy storage and effective energy management techniques such as Demand Response.

Short - Duration Storage: Energy storage to address short-term demand-supply mismatch is being addressed through an aggressive battery storage deployment strategy. Recent BESS Targets showcase India's ambitious plans of over 40 GW of Battery Energy Storage (BESS) by 2030 to provide firm, dispatchable renewable energy.

Long-Duration Storage: While lithium-ion is now the standard for short-duration storage, Mechanically Rechargable Zinc-Air batteries are emerging as a promising solution for seasonal storage because of its capability to store energy for months-years and power backup of 100+ hours.

- Safety & Density: They are non-flammable and offer 3x the energy density of Lithium-ion at the pack level.
- Indigenous Advantage: India is one of the leading zinc producers globally, allowing for a 100% recyclable, indigenous battery ecosystem that reduces dependence on imported lithium.
- Research Leadership: Institutions like IIT Madras and companies like Sthyr Energy are developing zinc-air systems capable of storing energy for months without self-discharge, ideal for shifting monsoon wind energy to other seasons to reduce curtailment and have reliable renewable power throughout the year.

Demand Response (DR) on the other hand leverages smart grid infrastructure to enhance the responsiveness of the demand side to variations between electricity supply and demand. Demand response programs shift the focus of power system management away from utilities alone and toward active customer participation. Shifting consumer energy demand to match Wind Generation especially during excess generation periods would help alleviate the curtailment losses from Wind sources effectively. Successful implementation of these programs requires an adequate level of technological readiness among all stakeholders. Identifying the technological capabilities necessary to enable demand response for a specific load category is therefore a critical task. The increasing digitization, large scale rollout of smart-meters across the country and innovative technology led transformation of the power sector through initiatives such as the India Energy Stack are helping address some of these growing challenges. Further, companies such as Elements Energy leveraging these efforts and deploying AI powered solutions for Demand Response can effectively solve the problem at hand, while also making the case for smarter and more energy

efficient operations to be the norm.

India has made tremendous progress in its shift towards renewable energy, the rise in Solar and Wind Generation has been nothing short of a monumental feat, but if India are to tackle the rising threats of Climate Change and meet its Net-Zero targets then it must ensure that every single electron of the clean energy generated is utilized to its full extent. The road ahead presents unique challenges that will require a dedicated effort cutting across technology, policy and deployment - ensuring we can address some of the systemic issues that threaten its foundation will be key to ensuring a smooth transition that is clean, stable and resilient.

Reference List

1. PIB Delhi (Jan 2026): Record-Breaking Renewable Expansion
2. The Hindu (Jan 2026): India scaled 54.51 GW wind capacity in 2025
3. Down To Earth (June 2025): Infrastructure Bottlenecks and 70 MU Curtailment
4. CEA / Ministry of Finance (Oct 2024): National Electricity Plan (Transmission) - ₹ 9.15 Lakh Cr Investment
5. IIT Madras / Modern Manufacturing (2025): Hindustan Zinc and IIT Madras Lead the Charge with Zinc-Air Battery
6. JMK Research (2025): India's Wind and Solar Capacity Trends

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Faheera S

WELCOME
IWTMA NEW MEMBER

Avanti Wind Systems: Safe Work in Wind Turbines for India's Growing Wind Sector

Avanti Wind Systems, part of Alimak Group, is a global leader in safe work in wind turbines. With engineering roots dating back to 1885 in Denmark, the company has built a long-standing reputation for improving safety and efficiency inside wind turbine towers.

In India, Avanti is actively supporting the rapid expansion of onshore wind by working closely with OEMs, IPPs, EPCs, and service providers. The company's core portfolio includes service lifts, safety ladders, fall protection systems, personal safety equipment, and certified safety trainings, all designed to meet international standards while adapting to local site requirements with more than 40,000 + service lifts from Avanti have been installed globally.

Avanti's offering extends well beyond equipment supply. The company provides end to end lifecycle support, including engineering assistance, installation supervision, inspections, maintenance, spare parts, and comprehensive safety training. This helps Indian wind operators reduce downtime, enhance technician safety, and improve long term operational efficiency while maintaining compliance with stringent safety norms.

As India increases its focus on localisation, site support, and stronger safety governance, Avanti is expanding its presence in key wind states to support both upcoming projects and repowering opportunities.

Being part of the Alimak Group, a global leader in vertical access and work at height solutions, further strengthens Avanti's engineering capabilities, service infrastructure, and safety first culture, bringing proven international expertise to the fast growing Indian renewable energy market.

For more information visit our:

Webpage: https://www.avanti-online.com/

LinkedIn: https://www.linkedin.com/company/avanti-wind-systems-a-s/

Abdul Shilly leads commercial development for Avanti Wind Systems in India, shaping the company's long-term market strategy at the intersection of safety, technology, and sustainable growth. With a clear vision for advancing work-at-height standards in the wind industry, he collaborates closely with OEMs, IPPs, EPCs, and ecosystem partners to drive localisation, innovation, and value-led adoption of global best practices. Abdul plays a pivotal role in positioning Avanti as a trusted partner in building a safer, more resilient, and future-ready wind energy sector in India.

WELCOME
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Vestas Wind Systems A/S

In mid-December 2025, Vestas reached the milestone of 200 GW of installed wind turbines globally. Achieving 200 GW of installed wind turbines is both a testament to Vestas' leading position within wind energy solutions and the scale at which renewables is growing in the global energy system. Vestas was also the first to reach 100 GW of installed wind turbines in 2018. A milestone that was four decades in the making, and in contrast the subsequent 100 GW have been installed in less than seven years, underlining wind energy's competitiveness, scale and fast deployment. It means >90,000 installed Wind turbine, ~156 million EVs charge/year, ~174 million EU household powered/year.

Company Profile

Vestas Wind Systems A/S is a leading Danish company and the world's largest manufacturer, installer, and servicer of onshore and offshore wind turbines, founded in 1945. With over 200 GW of wind turbines (including 10 GW offshore wind) installed globally across 88+ countries, +160 GW under active service contract for +55,000 wind turbines in +71 countries, the company focuses on sustainable energy solutions, employing over 35,000 people to accelerate the renewable energy transition.

Vision & Mission

With a clear mission to transform the global energy system, Vestas believes that wind power will form the backbone of future sustainable energy infrastructure. The company is committed to providing innovative energy solutions that reduce carbon emissions and accelerate the transition to clean energy worldwide.

Founding & History

Vestas was founded in 1945 by Peder Hansen and has evolved from a general steel products business into the largest dedicated wind turbine company in the world. Over decades, Vestas has pioneered landmark innovations, from early onshore turbines to advanced offshore technology.

Global Presence

- Headquarters: Aarhus, Denmark
- Employees: Over 35,000 worldwide
- Vestas has succeeded in bringing renewable energy to 39 markets.
- Market Reach: Operating across Europe, North America, South America, Asia, and Australia, with manufacturing facilities and service centers in multiple countries.

Key Regional Details:

- Northern & Central Europe (NCE): Covers Nordic countries, Central Europe, and the UK.

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- Mediterranean (MED): Includes Southern Europe, the Balkans, Africa, Middle East, and Central Asia.
- Asia Pacific (APAC): Consolidates China and former Asia Pacific regions, covering the Greater Asia region.
- Americas (AME/LATAM): Includes North and Latin America, with specific focus on markets like Brazil and the United States.
- Manufacturing: Main plants are in Denmark, Germany, Netherlands, Spain, Italy, Romania, UK, Poland, Spain, Sweden, Norway, India, China, Australia, Brazil, and the USA.

Core Business Segments

- Onshore : Vestas is the market leader with more than 40 years of experience in Onshore wind. Based on our own onshore wind turbine product design and development, we offer customers wind power solutions, and we take care of everything from siting manufacturing, construction, and installation to final commissioning in cooperation with our partners.
- Offshore : Vestas is becoming a leading player in Offshore wind with almost 30 years of experience. Based on our own offshore wind turbine product design and development, we offer customers wind power solutions, and we take care of all stages from siting through final commissioning.
- Service : Vestas is the global leader in Service within wind power with around +160 GW across +71 countries for our customers on long-term subscription-based contracts, making their assets operate more effectively.
- Development : Development helps our customers grow their business, which in turn generates order intake for Vestas.

Innovations & Capabilities

Vestas leverages unparalleled data-driven capabilities with real-time performance information from millions of sensors across its global installed base, enabling predictive maintenance, enhanced energy yield, and optimized project outcomes. It continues to advance turbine technology, including the V236-15.0 MW offshore turbine, among the largest in the industry.

Sustainability & Impact

As a company deeply rooted in renewable energy, Vestas emphasizes sustainable operations and environmental responsibility. Its projects have contributed significantly to reducing CO_2 emissions globally and establishing wind power as a mainstream energy source.

Onshore and Offshore

Onshore wind forms the backbone of tomorrow's sustainable energy system. It's abundant, cost-competitive and laden with benefits from job creation to energy independence and security. Vestas offers Wind Turbine Platforms for every segment.

Onshore

- 2 MW Platform : 2 MW Platform provides industry-leading reliability, serviceability and availability and is one of the most trusted platforms in the industry.
- 4 MW Platform : 4 MW Platform is designed for a broad range of wind and site conditions, both onshore and offshore.
- EnVentusTM Platform : Introduced in 2019, the EnVentusTM Platform architecture connects proven system designs from the 2MW, 4MW and 9MW platform turbine technology.

Offshore

- V236-15MW: Vestas has successfully installed and commissioned its flagship V236-15.0 MW offshore wind turbine prototype in Denmark, with the first unit producing power in June 2024. This 15 MW turbine, designed for high performance with 115.5-meter blades, is now in serial production, supporting major offshore projects like Poland's Baltic Power.

Leadership

Vestas is led by Group President & CEO Henrik Andersen and governed by a global leadership team focused on innovation, execution excellence, and scalability in evolving energy markets.

Vestas India - a part of APAC region is led by Mr Amar Variawa, Vice President and Country Head of Vestas India.

Vestas India

Vestas entered in Indian market in collaboration with NEG-Micon in 1996 and later on become an independent entity under Vestas Wind A/s. Under Make In India initiative, Vestas started local production through the world class and state-of-the-art manufacturing facilities in Gujarat and Tamil Nadu. These factories have been producing wind turbine components for domestic and export markets. Vestas has the biggest R&D centre in Vestas' world operating out of Chennai. Together with our customers, Vestas India's more than 4000 employees are bringing the world sustainable energy solutions to power a bright future.

Why Vestas Matters

Vestas stands at the forefront of the renewable energy revolution, combining decades of expertise, cutting-edge technology, and global scale to deliver reliable, cost-effective wind energy solutions. Its contributions are helping to shape a sustainable, low-carbon energy future for communities around the world.

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Editor: Parkavi

www.cooperwind.com

COOPER NEW ENERGY CO., LTD.

COOPERWIND

COMPANY PROFILE

Cooper New Energy Co., Ltd. was established in 2011 and is a diversified industrial group company. Its main business covers multiple sectors such as intelligent equipment, high-access lifting equipment, concrete tower equipment, safety protection equipment, wind turbine supporting equipment, and structural component integration equipment. It is a Chinese National Specialized and Innovative "little giant" enterprise, a National High-tech enterprise, and has obtained more than 160 patents.

Cooper has established long-term strategic partnerships with well-known domestic and foreign new energy enterprises such as China Huaneng Group, State Power Investment Corporation, China CSSC, China Three Gorges Corporation, Goldwind Technology, Windey Wind Power, Mingyang Intelligent, Enercon, Siemens Gamesa, etc., through a full range of low-carbon technology solutions and comprehensive benchmark demonstration projects. Cooper takes "green, cooperative, and sustainable" as its core values and is committed to "promoting energy transformation and creating a beauty era of new energy".

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Industrial Lighting

LED Lighting

Obstruction Light

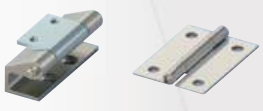
Floodlight

Industrial Mining Light

One-stop Integrated Manufacturing of Tower Structure Internals

One-stop Supply of Wind Turbine Tower Accessories

Hinges



Locks

Sealant Strips

Cable and pipeline protection system

Cable Trays | Cable Grommets | Cable Suspension Nets | Cable Clamps | Cable Brackets | Cable Sleeves | Cable Seal Penetrations

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