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# Cleantech

## — H E R O —



Industry Dossier on the innovations and updates in the Cleantech space

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## Disclaimer

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# Pioneering End-to-End Sanitation Solutions for Institutional Usecase



## Interview with Uttam Banerjee Co- Founder & CEO, Ekam Eco

*Ekam Eco Solutions is an Ahmedabad-based organisation that builds hygienic sanitation systems. One of their flagship products is Zerodor, a solution designed for odor-free and water-free urinals. We discuss this innovation and explore its environmental and social impact.*

### **What drove you to address the problem of water wastage in urinals?**

When we talk about sanitation, we often focus on aesthetics and whether we've achieved open defecation-free status. However, we rarely consider what happens to the waste after we flush and how it's managed. Our water bodies in urban areas are in a mess - our sanitation systems in cities being the primary culprit.

Water consumption and wastage are significantly higher, especially in commercial setups like offices, malls, theatres, and public institutions. The wastewater from these establishments often goes untreated. We focus on three main aspects to provide **end-to-end sanitation solutions** for **commercial B2B establishments and public spaces**.

- Reducing water wastage in restrooms
- Treating the sewage from restrooms
- Managing contamination in sewage caused by cleaning agents

### **What is the core mechanism behind Zerodor? How compatible is it with existing institutional urinals and restrooms, and are there any technical limitations?**

Typically, urinals are flushed to control odor caused by gases coming from the drain line. Urine, being a liquid, flows easily through gravity into the drain pipe, but gases generated in the pipe rise back into the washroom, creating the odor.

Zerodor is a small device that attaches to an existing men's urinal, allowing it to be retrofitted into the current setup. It works through a **mechanical one-way valve that creates a barrier between the drain pipe and the washroom**. The valve opens to let the urine flow into the pipe. After the flow stops, it seals shut, preventing gases from coming back up. This keeps the washroom odor-free, eliminating the need for flushing.



**Zerodor can be used with any urinal that has a provision for a standard waste coupling.** Waste coupling is the metallic fitting found at the centre of wash basins, connecting the basin to the drain. Zerodor replaces this in urinals. The product can be retrofitted easily if the urinal has a 40 mm (approx.) diameter pan with a waste coupling provision.

### ***What is the cost of implementing this solution?***

We offer different variants—some with pans, some without—using different materials and finishes, ranging from classic to premium.

Prices start at around ₹3,000–₹3,500 per urinal and can range from ₹14,000 to ₹16,000 per unit, depending on the variant.

### ***Have you analysed how long it takes for the product to pay for itself?***

On average, regardless of the model, **the return on investment (ROI) for retrofits is approximately 6 to 7 months.** We've calculated the ROI considering some key factors.

- First, there is **water savings—one urinal can save approximately 100,000 to 150,000 litres of water per year.** Without a waterless system, this water goes into the treatment plant, increasing operational and maintenance costs.
- Second, **pumping costs**—water must be pumped into overhead tanks for supply, adding costs for the pump, motor, and maintenance.
- Third, you save on **consumables** like chemical fragrances and urinal blocks.

You can avoid the installation of flushing lines and sensors altogether **for a new installation, reducing the ROI to 2 months.**

### ***How long has the product been in the market, and what were the initial market challenges you faced when introducing it?***

The product was officially launched in 2013, though we started installations as trials in 2009. **Some installations from 2011–2013 are still running smoothly.**

Initially, the main challenge was creating awareness, as people weren't familiar with waterless urinals as a concept. Another challenge was changing the mindset that flushing is mandatory, as we've all been conditioned from childhood to think it's essential. **It took time to convince people that a dry surface is better than a wet one.** We had to present medical reports and scientific evidence showing that waterless urinals are safer and more hygienic.

In the early days, some clients even faced backlash from their employees. This scepticism remains a challenge as we still need to reach a broader audience.

However, awareness has grown significantly in the last couple of years, especially post-COVID. We now receive nearly 20 inquiries daily from large corporations looking to install waterless urinals, often for green building certifications and water conservation.

### ***Are you concerned about product duplication?***

We're not particularly worried about product duplication. Some have tried copying us, but they have failed because it's not just about the product's technical aspects. We analyze everything, from restroom design to drain pipes, and offer customized solutions. The cost of the product depends on this level of customization. We also advise customers on best practices for maintaining their washrooms. We offer a one-stop solution for sanitation, health, and hygiene. Our deep understanding of the sector and customers' pain points helps ensure our success.

Additionally, the product contains trade secrets and proprietary elements that, if not copied accurately, will not function properly.

### ***What's your current scale of operations?***

We serve pan-India with installations from Kashmir to Kanyakumari. Our core team is based in Delhi, Mumbai, and Ahmedabad, and we have a plumbing team that handles installations nationwide. Additionally, we work with a network of channel partners.

We're also working on expanding internationally. So far, **Zerodor has over 60,000 installations. We've served around 700-800 customers with Zerodor and STP solutions.**



*Zerodor Co-founders with **Nithin Kamath (center)** from Zerodha. As a client, Nithin has vouched for the effectiveness of Zerodor solution in significantly reducing their office water bills.*

### ***What other products or technologies are currently central to your sanitation solutions?***

Apart from Zerodor, we're focusing on **sewage treatment solutions**. We believe sewage holds nutrients that can be recovered and reutilized. Our treatment systems are portable and scalable—if your initial load is 5 KLD and it increases to 10 or 15, you can simply add more units. These setups use specially formulated **aerobic and anaerobic biocultures to treat sewage into nutrient-rich, filtered water**, 60-70% of which can be reused for flushing, gardening, or cleaning.

We also offer a range of natural, plant and food-based cleaning products—like toilet and floor cleaners, dishwashing, and drain cleaning solutions—used by corporate housekeeping teams. These enzymatic cleaners support rather than harm the sewage treatment process. So, our three focus areas are waterless urinals, portable STPs, and natural cleaners.

# Understanding BESS and its Applications



By Dr. Rashi Gupta

Founder – Vision Mechatronics Private Ltd

We had the good fortune of getting in touch with Dr. Rashi Gupta, the founder of Vision Mechatronics, to gain valuable insights about Battery Energy Storage Systems (BESS) and the kind of impact BESS's rising popularity can have across industries.

**Energy storage has historically been more expensive than energy generation. Do you think BESS will become more popular in coming times?**



BESS is poised to become increasingly popular in the future. Several factors are driving this:

- **Decreasing Battery Costs:** Lithium-ion battery prices have plummeted, making battery energy storage systems (BESS) more economically viable.
- **Increasing Renewable Energy Penetration:** Intermittent renewable sources, such as solar and wind, require energy storage to ensure grid stability and reliability.
- **Grid Modernisation:** BESS supports grid modernisation by providing ancillary services, including frequency regulation, voltage support, and peak shaving.
- **Policy Support:** Many governments are incentivising BESS deployment through subsidies, tax credits, and favourable regulations, mandating 2 hours storage for large RE plants.

### ***Can you talk about potential impact on the renewable energy eco-system?***

- **Enhanced Grid Stability:** BESS balances supply and demand fluctuations caused by intermittent renewable energy sources.
- **Increased Renewable Energy Integration:** This allows for greater integration of renewables into the grid by storing excess energy during periods of peak production and releasing it during periods of low production.
- **Reduced Curtailment:** BESS minimises the amount of renewable energy that is wasted due to grid limitations.
- **Decentralised Energy Systems:** BESS enables the development of micro-grids and off-grid renewable energy systems, improving energy access in remote areas.

### ***As of today, does it make sense for MSMEs to adopt BESS?***

BESS is becoming increasingly favourable, especially when considering the emergence of the second-life battery market.

#### **First-Life BESS for MSMEs**

For some energy-intensive MSMEs or those highly susceptible to power outages, investing in a new (first-life) BESS can already be justified. This is particularly true if they can leverage BESS for multiple benefits, such as:

- **Backup Power:** Ensuring business continuity during grid failures.
- **Demand Charge Reduction:** Lowering electricity bills by discharging the battery during peak demand periods.
- **Renewable Energy Integration:** Maximising the self-consumption of on-site solar power.
- **Power Quality Improvement:** Protecting sensitive equipment from voltage fluctuations.

However, the upfront cost of a first-life BESS can still be a significant barrier for many MSMEs.

#### **The Second-Life Battery Game Changer**

This is where the concept of “second-life” batteries, such as Vision Mechatronics’s “RELIVE” Battery, becomes a game-changer.

**Second-life batteries are electric vehicle (EV) batteries that no longer meet the stringent performance requirements for vehicles but still retain a significant amount of their energy storage capacity (typically 70-80%).**



### How Second-Life BESS Benefits MSMEs:

- **Significant Cost Reduction:** Second-life batteries are substantially cheaper than new batteries, often 30-50% less. This dramatically lowers the initial investment for an MSME looking to adopt BESS.
- **Sustainability:** Utilising second-life batteries contributes to a circular economy by giving valuable resources a second life, reducing e-waste and the environmental impact of battery manufacturing.

- **Viable ROI:** The lower upfront cost of second-life BESS makes the return on investment much more attractive for MSMEs, potentially leading to quicker payback periods through reduced energy costs and avoided downtime.

### Which industries can the Second-life Battery BESS adoption make the most impact in?

- **Manufacturing:** Small and medium-sized manufacturing units often face high energy costs and production losses due to power outages. Second-life BESS can provide reliable backup and help manage peak demand, improving profitability.
- **Hospitality (Small Hotels, Restaurants):** Ensuring uninterrupted power for essential services, refrigeration, and customer comfort is crucial. Second-life BESS offers a cost-effective way.
- **Agriculture and Food Processing:** Maintaining cold chains and powering essential equipment in rural areas with unreliable grid access can be significantly improved with affordable, second-life battery energy storage systems (BESS) coupled with renewable energy.
- **Small Data Centres and IT Services:** Even smaller businesses rely on consistent power for their IT infrastructure. Second-life BESS can provide a budget-friendly backup power solution.
- **Commercial Buildings (Small Offices, Retail):** Reducing peak demand charges and providing backup for critical systems like lighting and security can lead to significant cost savings.



## ***What are the most common BESS sizes currently being deployed in industries? What is the difference between them in terms of cost and energy storage?***

BESS sizes vary significantly depending on the application. **Common industrial sizes include:**

- **Small-scale (100 kW - 1 MW):** Used for peak shaving, demand management, and backup power for individual facilities.
- **Medium-scale (1 MW - 10 MW):** Deployed for grid support, frequency regulation, and integrating larger renewable energy projects.
- **Large-scale (10 MW+):** Used for large-scale grid stabilisation, renewable energy integration, and providing ancillary services.

### **Cost and Energy Storage Differences:**

- Larger BESS installations generally have lower per-kWh costs due to economies of scale.
- **Energy storage capacity and power rating influence the cost.** Higher capacity and power ratings increase the overall cost.
- The type of battery technology also affects the cost, with **LFP batteries often being more cost-effective than other lithium-ion chemistries.**

## ***For thermal management in BESS, which method, air cooling or liquid cooling, should be preferred in India?***

In India, Battery Thermal Management Systems (BTMS) are crucial due to the country's high ambient temperatures.

### **Cooling Preferences:**

- **Liquid Cooling:** Generally preferred for larger BESS installations and high-power applications due to its superior heat dissipation capabilities. It is more efficient in hot climates, which is very important in most of India.
- **Air Cooling:** Suitable for smaller BESS installations and applications with moderate power demands. It is less complex and less expensive, but may struggle to maintain optimal battery temperatures in extreme heat.

In India, due to the high ambient temperatures, **liquid cooling is generally more effective** at maintaining battery health and longevity.

## ***What are your thoughts on sodium-ion batteries? How do they fare against Lithium-ion / LFP batteries in terms of performance, cost and efficiency?***

Sodium-ion batteries are gaining attention in Battery Energy Storage Systems (BESS) due to sodium's abundance and lower cost relative to lithium. While their energy density (100–160 Wh/kg) lags behind lithium-ion (150–250 Wh/kg) and LFP batteries, they excel in safety, with reduced thermal runaway risks and better performance in extreme temperatures. Cycle life is improving, potentially matching LFP in the future.

Despite cheaper raw materials, **the current production costs of sodium-ion batteries remain similar to those of LFP due to their limited scale**; however, mass production could boost affordability. Sodium-ion batteries also offer fast charge and discharge rates, and can tolerate full discharge without damage.

**Hybrid systems, integrating lithium-ion's high energy density with sodium-ion's cost and safety benefits, are proposed as a strategic solution.** For example, Vision Mechatronics' lead-lithium hybrid project in Gurugram highlights this approach.

Despite the promising advancements in sodium-ion technology, lithium-ion batteries, particularly LFP, are well-established and continue to improve in performance and cost, indicating that **lithium is likely to remain a dominant player in the BESS landscape for the foreseeable future, with sodium-ion carving out its niche in specific applications.**

## ***BESS can be a fairly expensive endeavour, how often does it need maintenance?***

Considering the current affordability of Battery Energy Storage Systems (BESS), it's essential to recognise that the **maintenance frequency is influenced by several key factors.**

These include the battery type, with LFP generally requiring less maintenance compared to other chemistries; the operating conditions, and usage patterns, with high-cycle applications demanding more intensive maintenance.

**Typical maintenance procedures** involve regular inspections of connections, wiring, and cooling systems, comprehensive battery health monitoring and diagnostics, software updates and calibration, and periodic cleaning and component replacement.

While modern BESS systems benefit from sophisticated monitoring capabilities that have significantly reduced maintenance demands compared to earlier systems, at Vision Mechatronics, we have further enhanced this with our indigenously developed preventive and predictive monitoring system. **This advanced tool is capable of detecting potential failures up to 15 days in advance**, providing a highly effective means to avert complicated situations and problems, ensuring optimal performance and longevity of the BESS.

# A Discussion on **Bio-CNG** (Compressed Biogas)



**Vivek Sharma**

Principal Research Analyst – S&P Global

**Vivek Sharma**, Principal Analyst – Powertrain Forecasting, India at S&P Global Mobility, writes on the current stance of Bio-CNG in India, alongside his thoughts on future possibilities.

## ***Bio-CNG in India: Accelerating the Clean Mobility Transition?***

As India intensifies its push towards sustainable mobility and reduced dependence on fossil fuels, Bio-CNG (Compressed Biogas) is rapidly emerging as a **promising alternative fuel**.

With the dual advantage of **addressing the country's mounting waste management challenges and supporting its clean energy transition**, Bio-CNG sits at the confluence of environmental, economic, and agricultural priorities.

One of the key advantages of Bio-CNG lies in its significant environmental impact.

Beyond reducing tailpipe CO<sub>2</sub> emissions, it also **enables the capture and utilisation of methane—a greenhouse gas nearly 28 times more potent than CO<sub>2</sub>**—delivering substantial lifecycle emissions reductions. The quantification of carbon savings, particularly from upstream methane avoidance through the use of agricultural and municipal feedstocks, makes a strong case for Bio-CNG from a policy perspective.

India, although not currently a part of the Global Methane Pledge (GMP) launched at COP26, has made a strong climate commitment to achieving net-zero emissions by 2070.

Methane reduction through Bio-CNG production provides an impactful and pragmatic pathway for India to move toward these climate goals, especially given its abundant supply of biodegradable waste and rising demand for clean transport energy.



The following elaborates key facets of the Bio-CNG ecosystem in India:

## 1. Policy & Regulatory Framework

Recognising Bio-CNG's potential to support clean mobility and waste-to-energy goals, the Government of India has introduced several targeted initiatives:

- **SATAT (Sustainable Alternative Towards Affordable Transportation)**

A significant policy for Bio-CNG, SATAT aims to create a nationwide ecosystem by **supporting entrepreneurs in setting up plants and selling Bio-CNG to Oil Marketing Companies** for transport and industrial use. It also promotes the use of byproducts like fermented organic manure.



- **GOBAR-Dhan Scheme**

Anchored in the Swachh Bharat Mission (Grameen), this scheme supports cluster-level biogas plants in rural areas with financial aid of up to **₹50 lakh per district**, encouraging decentralised waste-to-energy solutions.

- **Waste to Energy (WTE) Programme**

Implemented under the National Bioenergy Programme, WTE supports Bio-CNG production from urban, industrial, and agricultural waste with central financial assistance, backed by a budget outlay of **₹600 crore** (2021-2026).

- **Market Development Assistance (MDA) Scheme**

Focused on promoting the uptake of organic fertilisers from GOBAR-Dhan and Bio-CNG plants, the MDA offers **₹1,500 per metric tonne** of fermented organic manure, strengthening the business case for Bio-CNG byproduct utilisation.

- **Green Credit Programme (2023)**

Though still evolving, this initiative aims to reward climate-positive actions. Including Bio-CNG under eligible activities could further incentivise production by offering **tradable environmental credits**.

## 2. Fuel Availability & Production Potential

India has an abundant biomass base, producing over **500 million tonnes of agricultural residue, food waste, and municipal solid waste annually**—a massive untapped reservoir of feedstock for Bio-CNG production. Currently, however, the number of large-scale, commercially operational Bio-CNG plants is limited. The transition from pilot to production scale has been slow due to technical and financial hurdles, but ongoing investment and increasing policy focus are accelerating growth in this space.

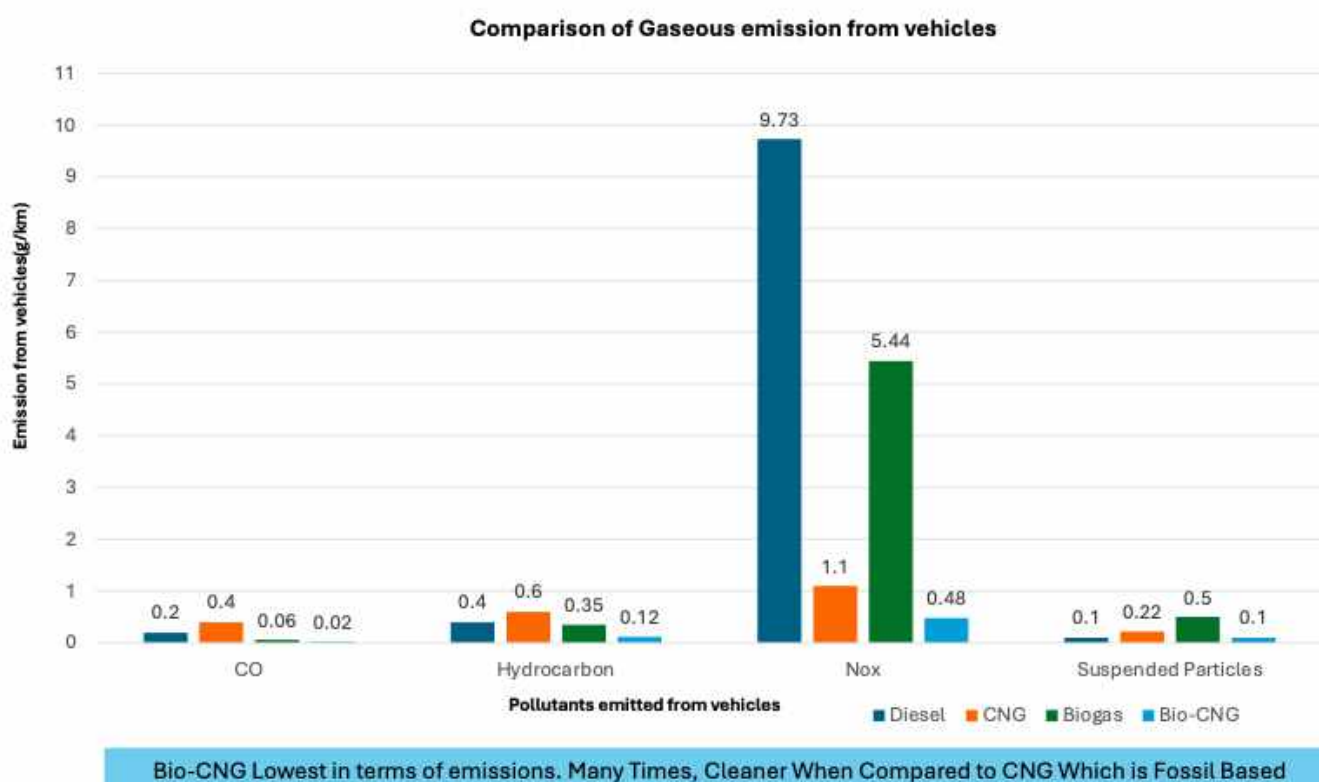
## 3. Vehicle Category Acceptance

Bio-CNG is **compatible with existing CNG vehicle platforms**, making it a near drop-in alternative. It's being adopted in three-wheelers, city buses, and light commercial vehicles (LCVs), with OEMs offering factory-fitted CNG vehicles that can run on Bio-CNG without modification.

Cities like **Pune** and **Indore** have successfully deployed Bio-CNG in their **municipal buses and garbage collection fleets**. There is a growing interest in applying Bio-CNG to heavy-duty commercial vehicles (HCVS), although issues such as higher torque requirements, engine compatibility, and fuel infrastructure need to be addressed.

## 4. Advantages Over Conventional Fuels

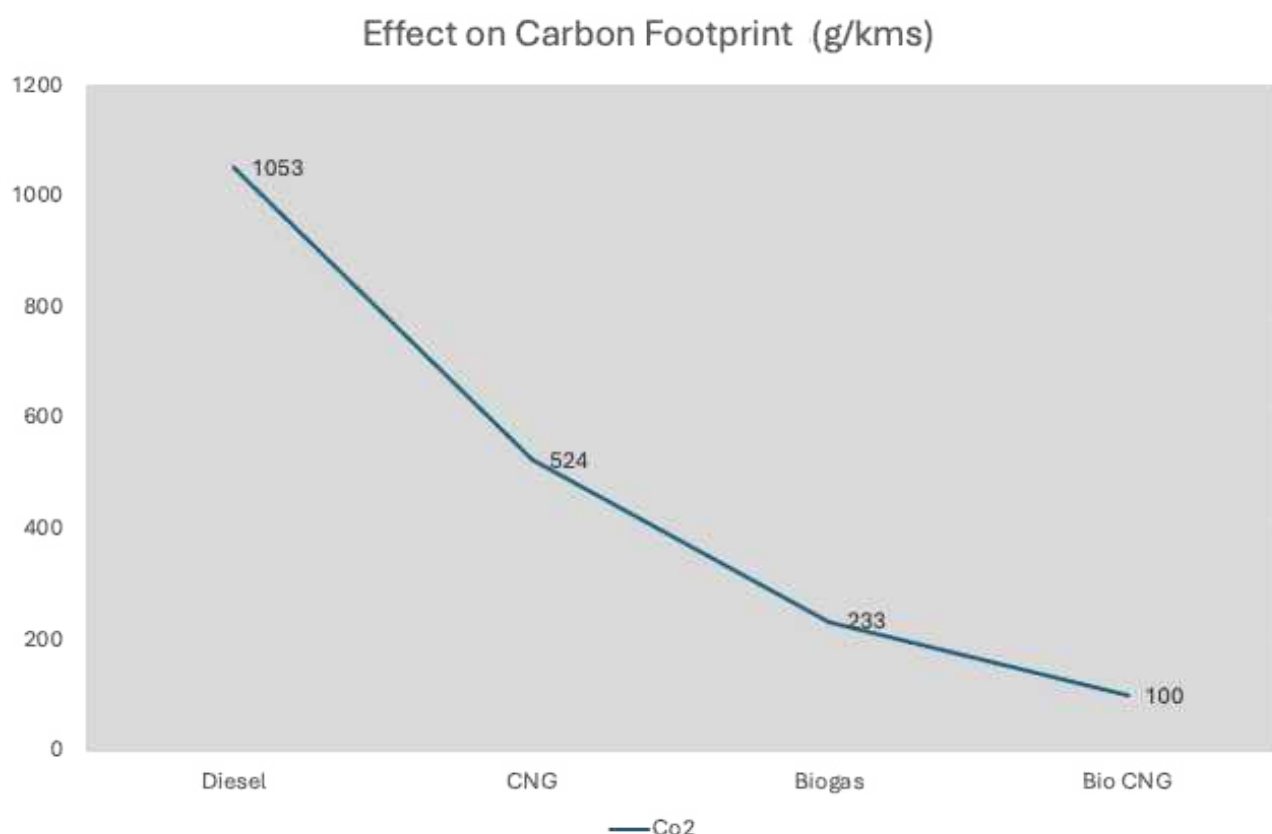
### Benefits of using Bio-CNG Compared to other Fuels



**Bio-CNG offers up to 20% lower greenhouse gas emissions compared to fossil-based CNG**, and significantly cleaner tailpipe emissions than diesel and petrol, which are major contributors to urban air pollution. Vehicles running on Bio-CNG emit lower levels of particulate matter (PM), nitrogen oxides (NOx), and sulphur oxides (SOx) compared to diesel, and generate **virtually no carbon monoxide or unburned hydrocarbons relative to petrol**. This translates to healthier air quality, especially in urban centres struggling with vehicular emissions.

Additionally, Bio-CNG's production from organic waste **captures methane**—a potent greenhouse gas—thus preventing its release into the atmosphere, while also **curbing landfill expansion and air pollution from crop residue burning**. This positions Bio-CNG as a true circular economy enabler, transforming waste streams into clean, usable fuel.

Furthermore, by reducing India's dependence on imported natural gas and crude oil, Bio-CNG enhances energy security. Its **decentralised production model promotes rural entrepreneurship**, and strengthens local economies.



## 5. Challenges to Adoption

Despite strong fundamentals, Bio-CNG faces structural and operational challenges. **Feedstock logistics remain inefficient**, and **building plants is capital-intensive**, requiring long-term financing and technical know-how. Limited fuel dispensing infrastructure restricts scalability.

OEMs and fleet operators also express concerns around fuel quality, consistency, and engine performance on Bio-CNG, especially in demanding commercial applications.

## 6. Outlook

In 2023, the National Biofuels Coordination Committee, chaired by Petroleum Minister Hardeep Singh Puri, announced the **phased blending of compressed biogas (CBG) with compressed natural gas (CNG) for transportation, and piped natural gas (PNG) for households, starting from the financial year 2025-26.**

The target is to achieve a **5% blending rate by 2028-29.** According to the Petroleum Ministry, the blending of CBG in total CNG and PNG consumption is set at 1% in 2025-26, increasing to 3% in 2026-27 and 4% in 2027-28.

Looking ahead, Bio-CNG is well-positioned to become a critical pillar of India's clean mobility roadmap. With increasing environmental consciousness, favourable policies, and investment momentum, its use is expected to grow, particularly in urban and regional transport sectors. As infrastructure scales and costs reduce, Bio-CNG can offer a compelling, sustainable fuel alternative across multiple vehicle segments, contributing to India's energy transition and net-zero ambitions.

### Concluding Remarks

Bio-CNG stands at the intersection of India's clean mobility vision and its circular economy aspirations. It not only helps reduce tailpipe CO<sub>2</sub> emissions but also captures and utilises methane—a highly potent greenhouse gas—offering deep environmental gains across the value chain.

The Indian government has played an instrumental role in accelerating this transition through forward-looking policies like SATAT and GOBAR-Dhan, which support decentralised renewable fuel production while also enabling rural development and sustainable waste management.

With India's natural gas consumption rising rapidly and import dependence increasing, **CNG prices are becoming more vulnerable to global fluctuations.** For instance, the domestic natural gas price was recently increased to \$6.75 per MMBtu for April 2025—a 4% jump from the previous month. This reinforces the case for accelerating Bio-CNG adoption, which can help mitigate exposure to import volatility and support long-term price stability.

OEMs like **Maruti Suzuki & Tata Motors** are already working on integrating **Bio-CNG compatibility into their factory-fitted CNG models**, a move that reflects growing industry confidence in the fuel's potential. As production ramps up and infrastructure improves, Bio-CNG could emerge as a crucial enabler for sustainable mobility, particularly in commercial fleets and urban transportation.

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To submit your inputs for this section,  
please write to us at

 [info@cleantechhero.com](mailto:info@cleantechhero.com)



# Seaweed-based Biodegradable Packaging Materials | Zerocircle



## Interview with Neha Jain, Founder – Zerocircle

*Zerocircle develops and provides **seaweed-based, biodegradable packaging alternatives** as sustainable solutions. They aim to create circular, carbon-neutral solutions that replace harmful petrochemical-based materials and reduce plastic waste.*

### **Can you talk about the primary areas of focus for Zerocircle?**

We are a material science company creating clean and green materials from seaweed as alternatives to conventional plastics extracted from fossil fuels. Scientists at Zerocircle focus on creating materials that **don't leach any harmful substances once they are no longer in use**, and then degrade naturally even in poorly managed environments.

Our seaweed-based solutions **replace hard-to-recycle plastics, such as polyethene and polypropylene single-use films, invisible barrier coatings for food and invisible adhesives** (to name a few), while tackling complex biomaterial challenges like hydrophobic coatings, all with a commitment to clean chemistry. Our coatings also specifically tackle pollution caused by PFAs—also known as 'forever' chemicals—which can be found in food packaging, especially food takeaway and disposable food packaging.

### **Solutions beyond packaging**

Our vision, however, goes beyond packaging. Our tree-free paper is made from Sargassum, a seaweed that constitutes the largest algal bloom in the Atlantic. This harmful bloom stifles marine ecosystems. It's a great instance of how we turn waste to value by using wasted resources of the ocean and reinforcing it with wasted resources of the land, which end up causing unprecedented air pollution. **Our products, therefore, stand at the intersection of ocean conservation, waste reduction, and climate action.** They deliver high performance—our thin films are stronger than polythene, and our label sticker adhesives improve recyclability while withstanding condensation. Importantly, our cost-effective solutions are designed to be affordable and accessible to the masses.

Our materials are used to manufacture products like barrier coatings (for F&B industry), pellets and thin films (for textile, fashion and FMCG), and seaweed paper (for secondary packaging requirements).



***Zerocircle uses 'low energy green processing' technology, can you explain the technological aspects involved?***

Zerocircle uses what we call low-energy green processing—a technology designed to avoid harsh chemicals, high energy consumption, and complex industrial steps. Unlike conventional plastic manufacturing, which depends on fossil fuels, extreme heat, and heavy machinery, our process extracts natural polymers (polysaccharides) from seaweed using gentle, energy-efficient methods



We consciously avoid high-pressure reactors, multiple solvent extractions, and other intensive chemical treatments. Instead, our R&D focuses on preserving the natural properties of seaweed while developing materials that are safe for food contact, biodegradable, and home-compostable. **These materials match the performance of single-use plastics, without the long-term environmental cost.**



***Can you discuss the differences between seaweed packaging and traditional packaging methods?***

- No dependence on fossil fuels or any resource that competes with feedstock
- Traditional packaging, especially plastic laminates and coated paper, offers strong barriers against grease, moisture, and air, but often at the cost of environmental impact. Seaweed-based coatings, developed by Zerocircle, now match and exceed these performance metrics with natural grease- and oil-resistance, all while being free from harmful chemicals like PFAS. Plus, it's inherently marine-safe and food-safe.



- Conventional packaging materials rely on petroleum-based inputs and complex, energy-intensive processing. Seaweed packaging uses renewable marine biomass and **can be processed using existing plastic or paper manufacturing infrastructure**, reducing the need for entirely new systems. This makes it scalable and cost-efficient in the long term, especially as fossil fuel costs and environmental compliance fees rise.
- Plastic-coated and dispersion-coated papers are notoriously hard to recycle or compost due to their mixed-material nature, often ending up in landfills or oceans. In contrast, Zerocircle materials are hyper home compostable, 100% biodegradable - decomposing quickly in natural environments without releasing toxins or microplastics

***What type(s) of seaweed do you use for packaging? Specifically, is there a particular type(s) of plastic you replace?***

**We use red and brown seaweed species for various products.** We are specifically replacing single use and hard to recycle plastic alternatives. The process starts with cleaner materials that don't leave anything harmful behind. Our products are being manufactured for primary and secondary packaging requirements for **high-demand industries like food & beverage, fashion and textile, FMCG and electronics**, to name a few.

Our focus has been on identifying specific use cases of single use plastics which are the hardest to recycle, are single use and take years to degrade. For instance PE- coated and aqueous coated food boxes which are used by most F&B players is one of the biggest causes of microplastics in our environment. Environmentally, these materials are often un-recyclable due to their multi-layer composition, leading to persistent landfill waste and microplastic pollution. From a health POV, many coatings contain PFAS or other synthetic additives that can leach into food, raising concerns over long-term exposure.





### ***In which domains/industries can one use the end products of Zerocircle?***

Zerocircle's materials are designed to seamlessly integrate into industries that are actively seeking sustainable alternatives to conventional plastic and wood-pulp-based packaging.

In the food and beverage industry, especially in takeaway, QSR (quick service restaurants), and HORECA (Hotels, Restaurants, and Catering), our seaweed-based coatings and paper solutions offer a direct replacement for traditional plastic-lined or fluorochemical-coated packaging. Whether it's clamshells, sandwich wraps, burger boxes, or bakery packaging, our materials provide the same grease and moisture resistance—minus the microplastics and PFAS. They're not only home-compostable but also safe for direct food contact, which is critical for both consumer health and regulatory compliance.

Beyond food, we see strong relevance in fashion, textiles, FMCG, and electronics—sectors under increasing pressure to reduce plastic and carbon footprints. **Our films and flexible packaging solutions can also be used in garment packaging.**

### ***Aside from seaweed packaging, what other product(s) does Zerocircle offer?***

While Zerocircle is best known for its work with seaweed-based packaging materials, our vision extends far beyond flexible packaging. At our core, we are a material science company focused on engineering the next generation of regenerative materials that are safe for people and the planet.

As we grow, we're expanding our R&D to tackle some of the most persistent and polluting plastics in the system—materials that are notoriously difficult to recycle and often end up in landfills or oceans. One of our key areas of innovation is focused on **developing plastic-free alternatives to polystyrene (thermocool)**, widely used in foodservice, consumer electronics, and insulation, yet one of the most environmentally damaging and non-degradable plastics in circulation.

We're also broadening our **portfolio of barrier coatings**—moving beyond just food packaging into areas like consumer goods and e-commerce, where grease, oil, and moisture resistance are essential, but current solutions rely heavily on petrochemicals. Our goal is to deliver high-performance coatings that are fully biodegradable and compatible with existing paper and fibre-based substrates.

In addition, we're exploring biodegradable **alternatives to synthetic adhesives**, which are used in everything from labels and tapes to multi-layer packaging. These adhesives, while small in volume, play a major role in making packaging un-recyclable.





### ***Can you talk about the positive environmental impact generated by Zerocircle's products through a quantitative lens?***

Today, **less than 1% of paper cups and food containers are recycled globally**. Over 95% of them are lined with plastic or wax, making them incompatible with traditional recycling systems. As a result, an estimated 250 billion such items are landfilled or incinerated each year, releasing toxic emissions and adding to the world's growing microplastic crisis. In fact, studies show that just one paper cup filled with hot liquid can release up to 25,000 microplastic particles, many of which end up in our air, water, and food systems.

Our seaweed-based, fully compostable materials offer a cleaner, scalable alternative. Our solution is not just free of plastics like PE, PP, and PFAs—it's made from locally sourced seaweed, grown in one of the richest supply zones globally, accounting for 97% of the world's seaweed farming.

From an industry lens, the **F&B sector alone consumes 78 million tonnes of plastic annually**.

To date, Zerocircle has **replaced over 100,000 plastic packaging items within the food and beverage sector**.

That's a significant reduction in carbon emissions, deforestation, and marine pollution—and a powerful step toward eliminating the microplastics we can't even see but are increasingly inhaling or ingesting every day. Every single unit we replace represents a conscious step away from pollution-heavy packaging and toward a regenerative material future—where what we take from nature returns to it safely.





# BluJ Aero | Developing VTOL Air-carriers

Excerpts from interview with **Maruthi Amardeep**, Founder – BluJ Aero



***Can you give us a brief about BluJ Aero? What impact can it have towards climate change?***

BluJ Aero is an **aerospace technology company** developing **long-range, hydrogen-electric powered Vertical Take-off and Landing (VTOL) aircrafts** for regional air mobility.

Our goal is to make air travel faster, cheaper, and greener by utilising a **hybrid hydrogen-electric propulsion system**.

We are looking to revolutionise transportation for regional and urban use cases. We feel that currently transportation is 2-dimensional in nature and thereby congested.

With BluJ Aero, **we hope to make transportation 3-dimensional**, using the concept of air taxis and autonomous air-carriers that use Vertical-Take off and Landing (VTOL) technology.

Speaking on climate change, I would say BluJ Aero will have a huge impact, since we essentially produce zero harmful emissions.



### ***How economical will the transportation services be for a day to day user?***

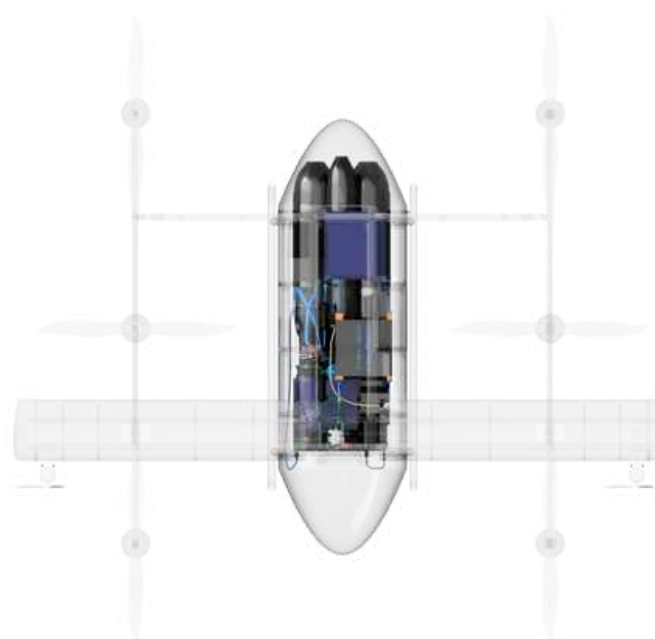
Initially, air services will be for premium users only.

However, we eventually plan on making these services affordable for a day-to-day user. We plan on doing this by 2035, when our total cost of operation would not be more than 1.5 times the cost of say, an Uber. Since our air-carriers will be VTOL carriers, we plan on making travel and transportation more accessible to people, reducing travel-time and GHG emissions simultaneously.

### ***Can you tell us a bit about the Hydrogen-Electric propulsion technology BluJ uses? Is it Patented and thereby exclusive to BluJ?***

No, it is neither patented nor exclusive, it has also previously been used in other modes of transport. However, we at BluJ, are working on innovating the overall engineering process, making the carriers more reliable and reducing the weight.

That's one of the main reasons we focus on Hydrogen propulsion is because batteries with current technology are quite heavy. **Even in the foreseeable future, we anticipate that battery weight is going to be a significant factor that decides the range of an air carrier.** This is where Hydrogen comes in, helping in reducing the overall weight of the carrier and thereby increasing the range.



We inherently use hydrogen to power the fuel cells, and **switch between fuel cells and batteries** through the entire journey to power the aircraft.

### ***When do you power your carrier with batteries, and when do you power it with fuel cells?***

It depends on the kind of range we are covering. Batteries can have either a very high discharge rate or a high energy density, but not both.

Since that is the challenge, **we use batteries during the heavy power phase** because they are good in their response time as well. In other cases, like cruise modes, 80-90% of our power comes from fuel cells. It essentially depends on the type of mode we are using.



**Can you tell us the different kind of products BluJ Aero currently offers? What kind of material do you use for them?**

We are basically working on 2 aircrafts.

- One is a **cargo specific variant** which can carry payload over 250 kilometers of range (BluJ Reach).
- The other is a **passenger variant** which will carry 6 passengers with around 600 kilometres of range (Bluj Hop).

Both of these come with a fully battery-powered variant.

The majority of the material we use is **carbon fibre**, primarily because it is significantly lighter than other materials like aluminium or steel. Due to the lighter weight, we can either increase the payload we carry or reduce the fuel we burn, which helps us make our carriers more efficient.



*BluJ Hop*



*BluJ Reach*

**AMPIN** Energy Transition has secured a **\$50 million** investment from **Siemens Financial Services** to support its growth in commercial and industrial and utility-scale renewable energy projects.



- This is AMPIN's third major investment transaction in the current financial year, bringing total equity raised in the year to \$270 million and overall equity capital to nearly \$700 million, enabling capital deployment of over \$4 billion.
- Headquartered in New Delhi, the company has a 5 GWp RE portfolio across 22 states.



**ReNew** has inaugurated a **1.3GWp** solar power project in Jaisalmer, Rajasthan on April 17, 2025. This project uses 100% Made-by-ReNew solar panels, and will supply electricity to people at the rate of **₹2.18/kWh**.

- Spread across around **3,500 acres**, the project is expected to generate **2,490 million** units of electricity annually.
- It is estimated to meet the demand needs of around 5 lakh households.



**Crompton Greaves Consumer Electricals** receives a Letter of Award from the Maharashtra Energy Development Agency to supply **433 solar water pumps**.

- The project, valued at around **₹10.60 crore**, will be implemented across various locations in Maharashtra.

**Suzlon Group**, a renewable energy solutions provider, has secured a **100.8MW** EPC wind order from **Sunsure Energy**, an Independent Power Producer (IPP).



The project is set to be executed in Maharashtra's 'Jath' region. Suzlon will supply **48 S120 Wind Turbine Generators (WTGs)** with Hybrid Lattice Towers (HLT), each rated at a **2.1MW** capacity.



**Suzlon Group** has expanded its partnership with **Jindal Renewables** by securing a third wind energy order of **204.75MW**, bringing their total collaboration to **907.20MW**.

- The new order comprises **65 S144 wind turbines**, each with a capacity of 3.15 MW.



**Serentica** has signed a Power Purchase Agreement with **NTPC Limited** to supply 200MW of firm, dispatchable renewable energy to distribution companies in Uttar Pradesh.

The project will use over 600MW of combined solar, wind, and battery storage systems across multiple sites.



**Tata Power Renewable Energy Limited** has signed a Power Purchase Agreement with **NTPC Limited** to develop a 200 MW firm and dispatchable renewable energy project at an estimated cost of **₹4,500 crore**. The project aims to generate around 1,300 million units of electricity annually.



**JSW Neo Energy Ltd**, a subsidiary of JSW Energy, has completed the acquisition of a **4.7GW** renewable energy platform from **O2 Power**, valued at an enterprise amount of approximately **₹12,468 crore** after adjustments.

The company expects to generate around **₹1,500 crore** in EBITDA from 2,259MW of capacity projected to be operational by June 2025.

**Sunsure Energy** has signed an **11MWp** long-term Power Purchase Agreement with **JSL Super Steel**, a subsidiary of Jindal Stainless, to supply solar power from its 49MWp project in Augasi, Uttar Pradesh.



- The agreement will help deliver around 16.5 million units of electricity annually.



**Tata Power** has received approval from the Maharashtra Electricity Regulatory Commission (MERC) to install a **100MW** Battery Energy Storage System (BESS) in Mumbai over the next two years.

- The system will feature '**black start**' functionality for faster power supply recovery and will be installed across 10 strategically located sites.

**Bharat Petroleum Corporation Limited (BPCL)** and **Sembcorp Green**, a subsidiary of Sembcorp Industries, have entered into a joint venture to develop renewable energy and green hydrogen projects.



**IndiGrid** has commissioned **India's first regulated utility-scale standalone Battery Energy Storage System (BESS) project**, the Kilokari BESS Private Limited (KBPL), designed to integrate renewable energy into the distribution grid.



- The 20 MW/40 MWh capacity project will be located in Delhi.



**L&T Energy Green Tech Limited**, a subsidiary of Larsen & Toubro, has incorporated a new wholly owned subsidiary, L&T Green Energy Kandla Private Limited (LTGEK), on April 4, 2025.



**Shakti Pumps Ltd.** receives a Letter of Award from Maharashtra Energy Development Agency (MEDA) for **445 Off-grid Solar Photovoltaic Water Pumping System (SPWPS)**.

The total amount of the work order is for around **INR 12.42 Crores**.



**Onix Renewable** plans to set up **7GW** of energy projects with an investment of nearly ₹25,000 crore, as part of its broader goal to develop a 10GW portfolio and invest ₹30,000 crore over time.

**Sterling and Wilson Renewable Energy (SWREL)** has secured projects worth **₹1,470 crore**, including two new domestic letters of award from private independent power producers (IPPs) and being declared L1 for a 200MW AC solar project.



**Indian Renewable Energy Development Agency Limited (IREDA)** signed a Facility Agreement to raise External Commercial Borrowing from SBI, Tokyo Branch for **JPY 26 billion**, including a Green Shoe Option of JPY 10 billion.

ONGC's wholly owned subsidiary, **ONGC Green Limited (OGL)**, has acquired a 100% equity stake in **PTC Energy Limited (PEL)** for **₹925 crores**.



**ONGC NTPC Green Private Ltd**, a 50:50 Joint Venture Company of NTPC Green Energy Limited and ONGC Green Limited, acquires **Ayana Renewable Power**, a renewable energy platform with a capacity of around **4112MW**. The acquisition cost was **INR 6248.50 crore**.



**Hitachi Energy HVDC technology** has been selected by Rajasthan Part I Power Transmission Limited, a subsidiary of **Adani Energy Solutions Ltd.** (AESL), to transmit renewable energy from Bhadla (Rajasthan) to Fatehpur (Uttar Pradesh).

- The project involves a **950km** HVDC connection that will deliver **6,000MW** of power, enough to supply energy to approximately 60 million households.

**SPML Infra Limited** has signed an exclusive agreement with **Energy Vault (USA)** to fast-track the manufacturing and deployment of **Battery Energy Storage Systems (BESS)** through a technology transfer.

- The agreement sets a target of manufacturing at least 500MWh over the next 12 months and 30-40+GWh over the next 10 years



**Mahindra & Mahindra Swaraj Tractors Limited** and **Mahindra Susten** Partner to develop a **26MW** Solar Project.

- The solar energy project will supply clean energy to four Swaraj Tractor manufacturing facilities located in **Mohali** and **Dera Bassi** in Punjab.
- The project is expected to generate approximately **60 million kWh of renewable energy annually**.

**Varaha** has sold over **60,000** tonnes of carbon credits to **Klimote.co** through five contracts spanning biochar and afforestation projects in India and Nepal, with the agreements valued at several million dollars.



The company had earlier made its first large-scale sale of carbon removal credits in India in January 2025, selling **100,000 CDR credits** to **Google**.



**Ami Organics Ltd.** has fully commissioned its **10.80MW** DC solar power plant in Pratapnagar, Gujarat, consisting of two 5.40MW captive solar plants. Additionally, Ami Organics plans to develop another 5MW solar plant to supply the electricity requirements of its Sachin unit in Surat.

**Servotech Renewable Power System Limited**, secures a **2MW** solar rooftop project with the North Eastern Railway, Lucknow Division.





**Adani Energy Solutions Ltd.** (AESL) has secured a **₹2,800 crore** green energy transmission project in Gujarat aimed at supporting the production of green hydrogen and green ammonia.

**L&T Energy Green Tech Limited** (a subsidiary of Larsen & Toubro Ltd.) and **John Cockerill** have signed a Memorandum of Understanding to collaborate on Concentrated Solar Power (CSP) and Thermal Energy Storage (TES) technologies in India.



**Havells India Ltd** announces an investment of **INR 600 crore** in **Goldi Solar Pvt. Ltd.** Havells will acquire an approximate of 9% equity stake, depending on the final round size. The investment will be part of the **₹1300 crore** fund raised by Goldi.

**Sunsure Energy** has secured **₹128.82 crore** in long-term debt financing from Tata Capital and Aditya Birla Finance for its **49MWp** open-access solar plant in Augasi, Uttar Pradesh. The plant is expected to generate 72 million units of power annually.



**Jupiter International Limited** has raised **₹500 crore** from **ValueQuest** to support its solar expansion plans, marking ValueQuest's second investment in the company. The funding will help Jupiter scale its capacity to **5.6GW** for solar cells and **2.4GW** for solar modules.

**BluPine Energy** secures **₹1,787 crore** in structured financing from NaBFID to enhance its renewable energy portfolio and optimise solar assets.



**Premier Energies** and **RENA Technologies** announced a technology partnership focused on advancing N-Type solar cell processes and developing wet chemistry for next-generation tandem solar cells.

**Tata Motors** and **Tata Power Renewable Energy Limited** have signed a PPA to co-develop a **131 MW wind-solar hybrid renewable energy project**. The project is set to generate approximately 300 million units of clean electricity annually.



**Megha Engineering and Infrastructures** received a Purchase Order for an **INR 12,800 crores EPC contract** from the **Nuclear Power Corporation of India** to construct two 700MW nuclear reactors in **Karnataka**. This project marks MEIL's first initiative towards Nuclear Energy.



**Bharat Petroleum Corporation Limited** and **GPS Renewables** have signed a Joint Venture agreement to establish **compressed biogas plants** across the country.

- The Joint Venture aims to establish **8-10 CBG plants over the next few years** in Bihar, Odisha, Punjab, Uttar Pradesh, and West Bengal.
- The project will leverage agri-biomass and BPCL's city gas distribution zones for efficient operations.



**NTPC Green Energy Limited** awards **1,544 MW Wind Projects**, including a new **378 MW** order to **Suzlon Group**.

- The 378 MW project will be executed in the Gadag region of **Karnataka**.
- Suzlon will supply 120 S144 Wind Turbine Generators (WTG) with Hybrid Lattice Towers (HLT), each with a rated capacity of 3.15 MW.
- This is Suzlon's second order from NTPC Green in the last 8 months.

**Servotech Renewable Power System Limited** has secured an order for a 4.1MW on-grid rooftop solar project from **Waltair Division, East Coast Railway, situated in Visakhapatnam**. The project is valued at **₹15.8 crore**.



Servotech will undertake the design, manufacturing, supply, and commissioning of rooftop on-grid Solar Photovoltaic (PV) plants of varying capacities across multiple sites.



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Ministry of New and Renewable Energy (MNRE) announced India's total renewable energy capacity is **220.10GW** with **29.52GW** added in FY 2024-2025. Solar energy contributed 23.83 GW, bringing total solar capacity to 105.65 GW, while wind energy crossed 50 GW.

- In FY 2024-25, solar capacity had increased by **23.83 GW**, reaching a total of **105.65 GW**, consisting **81.01 GW ground-mounted**, **17.02 GW rooftop**, **2.87 GW hybrid**, and **4.74 GW off-grid**.
- Wind energy increased by **4.15 GW**, bringing the total to **50.04 GW**.
- Bioenergy capacity grew to **11.58 GW**, including **0.53 GW from off-grid and waste-to-energy projects**.
- Small Hydro Power reached **5.10 GW**, with another **0.44 GW** under development.
- India has **169.40 GW of renewable energy projects under development** and 65.06 GW tendered, including 65.29 GW from solutions like hybrid systems, round-the-clock (RTC) power, peaking power, and thermal + RE bundling.

As of February 2025, Indian Railways has installed **209MW** of solar power across 2,249 stations and service buildings, with 1,489 installations added in the past five years.



**The Ministry of Mines** has issued guidelines for establishing Centres of Excellence (CoEs) under the **National Critical Mineral Mission**.



खान मंत्रालय  
MINISTRY OF  
MINES

These CoEs will focus on R&D in critical minerals, including extraction and processing technologies, with the goal of achieving pilot-stage outcomes.

The Ministry of Mines said that it will launch the country's first-ever auction of Exploration Licences (ELs) in Goa, aimed at unlocking untapped critical and deep-seated mineral resources.

The **Assam Electricity Regulatory Commission** has approved the installation of **500MWh** of Battery Energy Storage Systems (BESS) in the state, aimed at reducing the carbon footprint of the power system.



The procurement will span a 12-year planning horizon, with the State Load Dispatch Center responsible for controlling and operating the systems via telemetry.



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