7. Stranded Renewable Power - Geography

At the Bharat Climate Forum 2026, a sobering reality was presented- while India's "green engine" is producing energy at record speeds, the "transmission tracks" and institutional frameworks are struggling to keep up. The paradox of having stranded power in a country with growing energy demands highlights a significant bottleneck in India's journey toward its 2030 climate goals.

1. Background and Technical Definitions

To understand the grid-integration crisis, it is essential to define the mechanisms that govern electricity movement in India-

Renewable Energy (RE) Curtailment- The act of reducing or shutting down the output of renewable energy plants by grid operators. This usually happens when generation exceeds the grid's capacity to transmit it or when it threatens grid stability.

Grid Evacuation- The process of moving power from the generation site (like a solar park in Rajasthan) to the main transmission network.

General Network Access (GNA)- A non-discriminatory regulatory framework for access to the inter-state transmission system.

Permanent GNA- Long-term guaranteed access for established plants.

Temporary GNA (T-GNA)- Short-term access, often used by newer or merchant power plants, which is more vulnerable to curtailment.

Voltage Oscillations- Rapid fluctuations in voltage levels caused by the intermittent nature of solar and wind power, which can damage grid equipment if not managed by compensators like STATCOMs.

2. India's Renewable Energy Landscape (2025-26)

India has emerged as a global powerhouse in clean energy, with capacity growth outstripping many developed nations.

Current Capacity Snapshot (November 2025)

Total RE Capacity- 253.96 GW (a 23% YoY increase).

Solar Lead- 132.85 GW (the primary driver of growth).

Wind Contribution- 53.99 GW.

Leading States- Rajasthan, Gujarat, Tamil Nadu, and Karnataka.

Global Standing

Sector	Global Rank	Significance
Solar Power	3rd	Massive scaling in the Thar desert and rooftop sectors.
Wind Power	4th	Concentrated largely in coastal and hilly corridors.
Total Renewable Capacity	4th	Combined strength of Solar, Wind, Hydro, and Biomass.
2030 Target	500 GW	India's commitment to non-fossil fuel capacity.

3. Critical Challenges in the Energy Transition

Despite the impressive numbers, energy experts at the Forum highlighted systemic risks that could lead to "stranded" investments.

A. Transmission Congestion and Stranded Power

The Rajasthan Case Study- While the state has commissioned 23 GW of RE, the grid can only evacuate 18.9 GW. This leaves 4,000 MW of clean energy "stranded" or wasted during peak solar hours because there is no "road" for the electricity to travel on.

B. Unequal Treatment (Permanent vs. Temporary GNA)

Discriminatory Curtailment- When the grid is overloaded, projects with T-GNA are often forced into complete shutdowns, while Permanent GNA projects continue to operate. This creates an uneven playing field and significant financial losses for newer investors.

C. Under-utilisation of Costly Assets

Efficiency Gap- High-capacity 765 kV transmission lines, costing ₹4,000–₹5,000 crore per corridor, are designed for 6,000 MW but often carry only 600–1,000 MW (less than 20% capacity). The cost of these under-utilised assets is eventually passed on to the end consumer.

D. Institutional and Technical Barriers

Governance Vacuum- The Grid Controller of India Limited prioritizes stability over utilization. There are currently no benchmarks to penalize the persistent underuse of transmission lines.

Technical Instability- Rapid injection of solar power causes technical risks like voltage oscillations. Mitigation technologies like STATCOMs (Static Synchronous Compensators) and reactive power systems are not yet deployed at a scale sufficient to handle the 2025-26 generation levels.

4. Government Initiatives to Bridge the Gap

The government has launched several multi-billion-dollar schemes to address these infrastructure and manufacturing hurdles.

Green Energy Corridor (GEC)- Specifically targets the creation of transmission "highways" to move RE from resource-rich states to industrial hubs.

Production Linked Incentive (PLI)- Encourages the domestic manufacturing of high-efficiency Solar PV modules and advanced battery storage to reduce reliance on imports.

PM-KUSUM- Decentralizes power by helping farmers install solar pumps, reducing the load on the central grid and promoting rural energy self-sufficiency.

National Green Hydrogen Mission- Provides an "off-taker" for excess RE by using it to produce hydrogen for the steel and fertilizer sectors.

Renewable Energy Hybrid Policy- Promotes the co-location of wind and solar to ensure a more "level" power output, as wind often blows when the sun isn't shining.

5. The Way Forward- Expert Recommendations

To move from "Capacity" to "Utilisation," the Forum suggested a fundamental shift in grid management-

1. **Expanded Mandate-** The Grid Controller of India must be held accountable for both grid stability and maximum asset utilization.
2. **Proportional Curtailment-** If power must be cut, the burden should be shared proportionately across all generators (GNA and T-GNA) to ensure financial fairness.
3. **Technological Upgradation-** Immediate large-scale deployment of advanced protection systems and reactive power compensators to handle "peaky" renewable loads.
4. **Institutional Synergy-** Better real-time coordination between the Central Transmission Utility (CTUIL) and grid operators to align infrastructure planning with actual generation trends.

Source- https-//www.thehindu.com/business/indias-renewable-transition-caught-between-stranded-power-and-institutional-inertia/article70708147.ece