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India's 500 GW Ambition — Why Capacity Addition Is the Easy Part

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INTERVIEW ANGLE

"India has set ambitious renewable energy targets but grid integration, storage, and DISCOM financial health remain unresolved. What structural reforms are needed to make India's clean energy transition work?"

WHY IN NEWS

India's renewable energy capacity crossed 210 GW in early 2026, making it the fourth-largest renewable energy economy globally. But capacity addition, while impressive, conceals the harder challenges — grid stability, energy storage, distribution company (DISCOM) financial collapse, and industrial decarbonisation — that will determine whether India's 500 GW commitment by 2030 translates into a genuinely clean economy.

THE IMPRESSIVE PART FIRST

India's renewable energy addition over the past decade is, by any fair measure, a remarkable policy achievement. The country went from 2.6 GW of solar capacity in 2014 to over 100 GW in 2024 — a 40-fold increase in a decade. Total installed renewable energy capacity (including large hydro) is approximately 210 GW as of early 2026. Solar tariffs in India have fallen to below Rs 2 per kWh in competitive auctions — some of the world's lowest.

The policy instruments that made this possible deserve credit: competitive reverse auctions for solar and wind capacity (driven down developer margins and tariffs), the ISTS transmission charge waiver (enabling large-scale cross-state RE trade), solar parks (Bhadla, Pavagada, Rewa — aggregating land and infrastructure for developers), and Production Linked Incentives for domestic solar manufacturing (reducing import dependence on China). The PM Surya Ghar Muft Bijli Yojana targets rooftop solar at scale, while PM-KUSUM is deploying solar pumps for agriculture.

These are achievements. The analysis should start from them, not dismiss them.

THE GRID PROBLEM — WHAT HAPPENS WHEN THE SUN SETS

India's electricity grid is designed around a fundamental assumption: generation can be controlled to match demand at any moment. Coal plants, gas plants, and large hydro can be turned up or down as needed. Solar and wind cannot. Solar generates only during daylight; wind is variable by season and geography. As the share of solar and wind in India's power mix rises, the grid faces a new problem: large daily swings between surplus power in the afternoon (when solar peaks) and supply shortfall in the evening (when solar falls and demand rises as homes and businesses light up).

India's grid operators — Power System Operation Corporation (POSOCO), now merged into the National Load Despatch Centre (NLDC) — are already managing this. But at 100 GW of solar, the stress is manageable. At 280 GW of solar (India's 2030 solar target), without proportional storage capacity, India faces the same "duck curve" problem that California has managed with mixed results: massive midday solar surpluses and evening ramp-up crises that force expensive gas or diesel backup.

The National Energy Storage Mission's target of 380 GWh of battery storage by 2030 is the right ambition. The implementation is the problem. India's domestic battery manufacturing ecosystem is nascent; current large-scale battery storage projects depend on imported cells (predominantly from China). The supply chain risk — replicating India's solar panel import dependency in batteries — is real and has not been addressed by any equivalent domestic battery manufacturing PLI scheme with the scale of the solar PLI.

Pumped hydro storage (PSP) — which stores energy by pumping water uphill during surplus periods and generating when water flows downhill during deficit periods — has 96 GW of untapped potential in India, according to the Central Electricity Authority. But pumped hydro requires years to build, regulatory approvals from multiple state and central agencies, and significant upfront capital. India's pumped hydro pipeline is far behind where it needs to be.

THE DISCOM PROBLEM — STRUCTURAL FINANCIAL COLLAPSE

India's electricity distribution companies (DISCOMs) are the most critical and least visible bottleneck in the renewable energy transition. Every unit of solar or wind electricity generated must eventually be purchased by a DISCOM that sells it to consumers. If DISCOMs cannot pay, the entire RE value chain breaks.

India's DISCOMs have accumulated losses of approximately Rs 4.5–5 lakh crore as of 2022–23. These losses have structural causes:

> **State government populism:** subsidised or free power for agricultural and domestic consumers, with the gap financed by DISCOMs that never receive full compensation from state governments
>
> **High AT&C losses:** 18–20% of electricity is lost to technical deficiencies (poor wiring, transformers) and commercial losses (theft, unmetered supply) — among the highest loss levels in the world for a major grid

Cross-subsidy distortion: industrial consumers are charged above-cost tariffs to cross-subsidise residential consumers, incentivising energy-intensive industries to set up captive power plants and exit the DISCOM ecosystem, worsening DISCOMs' remaining customer mix

Regulatory capture: State Electricity Regulatory Commissions (SERCs) that set tariffs are nominally independent but effectively subordinate to state governments that resist politically unpopular tariff increases

The Revamped Distribution Sector Scheme (RDSS) with Rs 3.03 lakh crore aims to fix this through smart metering (250 million meters), infrastructure upgrades, and AT&C loss reduction to below 12%. RDSS targets are technically sound. But DISCOMs have been the subject of similar restructuring programs (APDRP, RGGVY, IPDS, UDAY) repeatedly over the past two decades. The structural problem — state government populism and political interference in tariff-setting — cannot be solved by infrastructure investment alone.

GREEN HYDROGEN — INDIA'S INDUSTRIAL DECARBONISATION BET

The National Green Hydrogen Mission (January 2023; Rs 19,744 crore; 5 MMT target by 2030) represents India's ambition to be a global green hydrogen producer and exporter. The logic is sound: India has excellent solar and wind resources (key inputs for electrolysis), a large potential domestic market (fertilisers, steel, refining), and geographic proximity to energy-importing markets in East Asia, Europe, and the Gulf.

The challenge is cost. Green hydrogen currently costs approximately $4–6 per kilogram to produce — compared to natural gas-based (grey) hydrogen at $1–2 per kilogram. The cost reduction required for large-scale adoption (approximately $1.5–2 per kg by 2030) depends on steep electrolyser cost declines and ultra-cheap renewable power. India's domestic electrolyser manufacturing is minimal; the mission's targets are more aspirational than near-term commercial.

The fertiliser sector is the clearest near-term opportunity. India's urea production (approximately 25–28 MT/year) uses natural gas for ammonia synthesis. Green ammonia (from green hydrogen) would eliminate CO_2 emissions from one of India's most subsidy-dependent sectors while also reducing dependence on imported LNG. But the economics require green hydrogen below $2/kg — a price that is at least 5–7 years away at current trajectories.

WHAT INDIA NEEDS BEYOND CAPACITY TARGETS

An honest storage roadmap. India's 500 GW RE target without a credible, fully-funded storage deployment plan is an incomplete commitment. The government should publish a storage deployment roadmap by source type (battery, pumped hydro, green hydrogen), with specific project pipelines and financing mechanisms. The VGF scheme for battery storage (Rs 9,400 crore for 4,000 MWh) is a start — it needs to be an order of magnitude larger.

A DISCOM restructuring with political commitments. RDSS will not work unless state governments commit to cost-reflective tariff increases and transparent subsidy accounting (Direct Benefit Transfer to subsidised consumers rather than subsidised tariffs for all). The Union government has leverage — RDSS funds are conditional on state commitments. It should use this leverage firmly.

A domestic battery manufacturing mission. India cannot afford to replicate its solar panel import dependency in batteries. A PLI scheme for battery cells, with technology transfer requirements and scale targets comparable to the solar PLI, is needed before China's dominance in battery manufacturing becomes as entrenched as it was in solar panels in 2014.

Industrial policy for decarbonisation. India's steel sector (approximately 130 MT production, 3rd largest globally) is one of the world's most carbon-intensive industrial sectors. A credible steel decarbonisation pathway — phased introduction of green hydrogen/direct reduced iron (DRI) steel, carbon contracts for difference to make green steel competitive, and export incentives for low-carbon steel — would position India's steel sector for the emerging global low-carbon trade architecture rather than facing carbon border adjustment mechanisms as a competitive threat.

The 210 GW milestone is genuinely worth celebrating. The 500 GW ambition is worth defending. But the transformation India needs — not just more capacity, but a structurally reformed electricity system with healthy DISCOMs, adequate storage, and industrial decarbonisation — requires harder political choices than setting capacity targets.

📌 FACTS CORNER — KNOWLEDGEPEDIA

GRID INTEGRATION:

POSOCO (now NLDC): Power System Operation Corporation; manages national grid dispatch

Duck curve: daily generation-demand mismatch caused by high solar penetration (surplus midday; evening ramp-up shortage)

Pumped Hydro Storage potential: 96 GW (CEA estimate); only ~4.8 GW currently operational

DISCOM FINANCIAL DATA:

Accumulated losses: ~Rs 4.5–5 lakh crore (2022-23)

AT&C losses: ~18–20% (target: <12% under RDSS)

RDSS: Rs 3.03 lakh crore; 250 million smart meters; 2021-2026

Previous schemes: APDRP → RGGVY → IPDS → UDAY → RDSS

STORAGE TARGETS:

National Energy Storage Mission: 50 GWh by 2027; 380 GWh by 2030

VGF for Battery Storage: Rs 9,400 crore; 4,000 MWh; approved 2023

GREEN HYDROGEN:

National Green Hydrogen Mission: January 2023; Rs 19,744 crore

Target: 5 MMT/year by 2030; 125 GW dedicated RE

Current green H2 cost: ~$4-6/kg (target: <$2/kg by 2030)

Grey H2 (natural gas): ~$1-2/kg

RENEWABLE MANUFACTURING:

PLI for Solar PV Modules: Rs 24,000 crore; 65 GW manufacturing capacity target

India's solar cell import dependence: ~70% from China (2022 baseline)

OTHER RELEVANT FACTS:

ISTS waiver: waiver of inter-state transmission charges for RE; enables cross-state RE trade

State Electricity Regulatory Commissions (SERCs): set tariffs; nominally independent

Carbon Border Adjustment Mechanism (CBAM): EU policy taxing carbon-intensive imports; covers steel, aluminium, cement, fertilisers, electricity from 2026

India steel production: ~130 MT/year (3rd largest globally)

Sources: MNRE, The Hindu, CEA

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