ujiyari

UPSC & STATE PCS CURRENT AFFAIRS · UJIYARI.COM

EDITORIAL ANALYSIS

Between Coal, Chaos and Green Power — India's Energy Transition Dilemma

DOWN TO EARTH

19 May 2026 · ENVIRONMENT · ECONOMY · GS3

CURATED & WRITTEN BY

Bharat Choudhary

UPSC Educator & Content Creator

linkedin.com/in/epicbharat

Between Coal, Chaos and Green Power — India's Energy Transition Dilemma

Down to Earth 19 May 2026 GS3

DTE Down to Earth | 3 tags

INTERVIEW ANGLE

"India's record 256 GW peak demand on April 25, 2026 revealed that renewable capacity addition alone cannot solve the energy transition problem — what systemic reforms are needed to make the grid flexible, storage-backed, and climate-compatible without triggering supply crises?"

EDITORIAL SUMMARY:

Down to Earth argues that India's record peak electricity demand of 256 GW on April 25, 2026 — where solar contributed roughly 24% during daytime but coal supplied 78–82% of evening and night power — reveals that the energy transition challenge is no longer about adding renewable megawatts but about building a flexible, storage-backed, and policy-coherent grid architecture. The editorial contends that India faces a planning failure, not a technology failure: the sun is abundant, but the policy architecture to integrate, store, and dispatch solar power intelligently is absent. It calls for retrofitting coal plants for flexible operation, a massive scale-up in grid-scale battery storage, and deeper domestic manufacturing across the green technology supply chain.

THE RECORD THAT REVEALED A STRUCTURAL PROBLEM

On April 25, 2026, India's power grid recorded its **highest-ever peak electricity demand: 256 GW**. The previous record — 250 GW — had been set in May 2024. That the record was broken within two years, during an April heatwave, is itself a signal worth reading carefully. Cooling load from an expanding urban middle class, increased industrial activity, and the compounding effects of climate-driven heat extremes are structurally driving demand growth. India's electricity demand is not plateauing — it is accelerating.

What made April 25 analytically important was not just the quantum of demand but its **composition across hours**. During peak daytime hours — roughly 10 AM to 4 PM — solar contributed approximately **24% of total generation**. This is a genuine achievement: India's installed solar capacity of approximately **150 GW** is now

large enough to meaningfully shape daytime supply. On sunny days, solar is surplus; in some states, curtailment (deliberately switching off solar to prevent grid overload) has already become a recurring problem.

But as the sun set, the grid's dependence on coal became absolute. Coal supplied **78–82% of evening and night power** — unchanged in its structural role despite years of renewable addition. India's **200+ GW of installed coal capacity** remains not just a legacy asset but an operational necessity that cannot yet be retired, reduced, or meaningfully displaced for nighttime demand.

This is India's energy transition in its current form: solar by day, coal by night, with almost no bridge between them.

THE DUCK CURVE: INDIA'S GRID REALITY

The phenomenon revealed on April 25 has a name in energy systems analysis: the **duck curve**. Named for the shape of the net demand curve when plotted against time of day, it captures a grid where:

- **Mid-day net demand drops steeply** as solar floods in, creating a trough that can stress conventional generators forced to ramp down rapidly
- **Evening demand ramps sharply back up** as solar disappears, requiring conventional generators — primarily coal — to ramp up quickly from their reduced mid-day output

Coal plants, however, were designed for **baseload operation** — continuous, stable generation at high capacity factors. They are not built to ramp up and down in response to solar intermittency. Rapid ramp-up stresses boiler components, reduces thermal efficiency, and increases emissions per unit of electricity generated. A coal plant cycling through a duck curve is simultaneously less economical and dirtier than one running at steady state.

The solution applied in advanced solar markets — California, Germany, South Australia — is **grid-scale storage**. Battery storage systems (predominantly lithium-ion) absorb surplus solar at midday and discharge during the evening ramp, smoothing the duck curve and reducing the burden placed on coal to respond to sudden demand surges.

India's current grid-scale storage capacity is approximately **4 GW** — almost entirely pumped hydro. The **Central Electricity Authority (CEA)**, in its Optimal Generation Mix 2029-30 report, has estimated that India needs **60–80 GW of grid-scale storage by 2030** to manage the intermittency of the renewable mix it is building toward. The gap between 4 GW and 60–80 GW is not just technical — it is financial, logistical, and policy-driven.

THE TARGETS INDIA HAS SET — AND THE GAP TO REALITY

India's official renewable energy ambition is **500 GW of non-fossil-fuel electricity capacity by 2030**. As of mid-2026, installed non-fossil capacity stands at approximately **210 GW**:

SOURCE	INSTALLED CAPACITY (APPROX.)
Solar	~150 GW
Wind	~56 GW
Large Hydro	~51 GW
Nuclear	~8 GW
Small Hydro / Others	~18 GW
Total Non-Fossil	**~283 GW**

To reach 500 GW by 2030 requires adding over **200 GW in four years** — an average of over 50 GW per year. India has rapidly scaled renewable additions — from under 20 GW annually in earlier years to 29.52 GW in FY2024-25 and a record 55.3 GW in FY2025-26. The gap between the trajectory and the target remains significant.

The **National Electricity Plan 2023** adds a further complication: it explicitly defers coal decommissioning to after 2030 and envisages **80 GW of new coal capacity under construction or planned**. This creates a paradox — India is building toward a renewable future with one hand while extending the coal horizon with the other. The National Electricity Plan's logic is that without coal as a firm backup, the renewable target itself becomes a grid stability risk. The logic is defensible. But it also means the "green transition" will be far slower and more fossil-intensive than official rhetoric suggests.

THE PLANNING FAILURES DOWN TO EARTH IDENTIFIES

Down to Earth's editorial frames the energy transition crisis explicitly as a **planning failure rather than a technology failure**. The technology exists — solar panels are cheap, batteries are improving, wind turbines are reliable. The failure lies in the policy and institutional architecture that should coordinate these technologies into a coherent energy system. Three specific planning failures stand out:

1. Inflexible Coal Fleet

India's coal plants were built for baseload operation. As the share of solar in the grid mix rises, these plants will increasingly need to cycle — ramp down at midday and ramp up in the evening. **Retrofitting coal plants for flexible ramp operation** requires investment in boiler controls, turbine modifications, and monitoring

systems. Without this investment, the duck curve will continue to stress the grid as renewable penetration increases, creating supply reliability risks that justify more coal — a self-reinforcing trap.

2. Insufficient Storage Pipeline

The **PLI scheme for battery storage** (Production Linked Incentive for Advanced Chemistry Cell batteries) was announced with an outlay of **Rs 18,100 crore**, targeting 50 GWh of domestic battery manufacturing. The solar modules PLI carries **Rs 24,000 crore** for domestic panel manufacturing — Tranche 1 targeted 10 GW of integrated manufacturing, with total allocation across both tranches at approximately 48 GW. Both are important — but the gap between PLI announcements and operational manufacturing capacity remains large. India still imports approximately **70% of its solar panels**, predominantly from China, and domestic battery manufacturing is in early stages.

The storage gap is not just about manufacturing — it is about financial structuring. Grid-scale battery storage requires long-term revenue certainty (power purchase agreements with storage components, capacity payments, or ancillary service markets) to attract private investment. India's electricity market design has not yet created these revenue streams at scale.

3. The PM Kusum Paradox

The **PM Kusum scheme** — which promotes solar pumping for agricultural irrigation — is a well-designed programme that reduces grid daytime peak load by enabling farmers to pump water during daylight hours (when solar is generating) rather than at night (when coal is generating). However, it also creates a **net metering complication**: where farmers can sell surplus solar back to the grid, the grid operator must manage additional variable supply that is geographically dispersed and difficult to forecast. Scaled across tens of millions of agricultural connections, this distributed solar can amplify the duck curve rather than smooth it.

WHAT A COHERENT TRANSITION POLICY REQUIRES

Drawing on the editorial's argument, a coherent energy transition policy for India would need several simultaneous interventions:

PRIORITY	POLICY INSTRUMENT
Coal flexibility	Mandatory flexible operation standards for all coal plants above 500 MW; retrofit subsidy under National Mission on Enhanced Energy Efficiency
Storage scale-up	Regulatory mandate for distribution companies to procure storage capacity; long-term storage PPAs with government backstop
Domestic manufacturing	Accelerate PLI disbursement; create a battery storage import substitution target analogous to the solar manufacturing PLI
Green hydrogen	Use surplus midday solar for green hydrogen electrolysis — converts the duck curve trough into an industrial opportunity
Demand flexibility	Time-of-use tariffs for industrial consumers to shift load from peak evening hours to midday solar surplus
Transmission	Build inter-state transmission corridors to move surplus solar from high-radiation states (Rajasthan, Gujarat) to high-demand states (Maharashtra, UP, Tamil Nadu) at scale

The editorial notes, with a nod to Sunita Narain's longstanding argument at Down to Earth, that India's energy challenge is ultimately a **governance and planning challenge**. India has the solar radiation, the land, the growing renewable industry, and the financial sector. What it lacks is the institutional architecture to align incentives, coordinate infrastructure investment, and hold grid operators accountable for a transition timeline.

UPSC MAINS ANALYSIS

GS Paper 3 — Environment and Economy: Energy Policy

- **India's 500 GW renewable target:** Progress, gaps, and credibility — the 2030 deadline in context of historical capacity addition rates
- **Duck curve and grid flexibility:** Why increasing renewable penetration creates new stability challenges; role of storage, flexible coal, and demand management
- **Coal phase-out paradox:** National Electricity Plan 2023 — why India is simultaneously building renewables and new coal; the energy security argument
- **Grid-scale storage:** Technologies (pumped hydro, lithium-ion batteries, green hydrogen); CEA storage targets (Optimal Generation Mix 2029-30); PLI for Advanced Chemistry Cells
- **PM Kusum scheme:** Design, implementation, agricultural solar penetration, and net metering complications
- **India's solar panel import dependency:** 70% import share; PLI for solar modules; China's dominance in global solar manufacturing supply chain

- **India's climate commitments:** NDC targets (500 GW non-fossil by 2030; 50% electricity from non-fossil by 2030); COP26-COP30 progression
- **CEA and electricity planning:** Role of Central Electricity Authority in storage estimates (Optimal Generation Mix 2029-30) and National Electricity Plan; role of CERC in market design and storage mandates

Keywords: duck curve India, 256 GW peak demand 2026, 500 GW renewable target, coal flexibility retrofit, grid-scale battery storage, CEA storage estimate Optimal Generation Mix, PLI Advanced Chemistry Cell, PM Kusum solar agriculture, National Electricity Plan 2023, solar panel import dependency, green hydrogen electrolysis, energy transition planning failure, pumped hydro India, solar curtailment, time-of-use tariffs, Grid-India formerly POSOCO, Down to Earth Sunita Narain energy.

India's grid recorded 256 GW peak demand — the highest in history; previous record was 250 GW set in May 2024; driven by heatwave cooling loads, industrial expansion, and growing urban electricity consumption; the Ministry of Power and Grid Controller of India Limited (Grid-India), formerly POSOCO (renamed November 2022), manage real-time grid balancing.

Solar ~150 GW (150.26 GW, per PIB), Wind ~56 GW (56.09 GW), Large Hydro ~51 GW (51.41 GW), Nuclear ~8 GW, Small Hydro and others ~18 GW; total non-fossil ~283 GW (283.46 GW) against 500 GW target for 2030; coal installed capacity exceeds 200 GW and remains the dominant source of dispatchable power.

The pattern on a power grid's net demand curve that resembles a duck — a deep trough in mid-afternoon (when solar is high, displacing other sources) followed by a steep evening ramp (when solar drops and demand rises); the ramp rate creates operational stress for coal and gas plants not designed for rapid cycling; first identified by NREL researchers in 2008 and named the "duck curve" by California ISO (CAISO) in 2013.

The Central Electricity Authority (CEA), in its Optimal Generation Mix 2029-30 report, has estimated India needs approximately 60.63 GW of grid-scale storage by 2030 to support reliable integration of the planned renewable capacity; current storage is ~4 GW (mostly pumped hydro); gap of ~56 GW represents one of India's largest infrastructure investment requirements.

Production Linked Incentive scheme with outlay of Rs 18,100 crore (official PIB figure); target: 50 GWh of domestic battery manufacturing; approved 2021; implementation has been slower than targets; key manufacturers selected include Ola Electric, Rajesh Exports, and Reliance New Energy.

Rs 24,000 crore outlay for domestic solar photovoltaic module manufacturing; Tranche 1 targeted 10 GW of integrated manufacturing; total allocation across both tranches is approximately 48 GW; India currently imports ~70% of solar panels, predominantly from China; PLI aims to reduce import dependency and build a domestic supply chain.

Prepared by Central Electricity Authority (CEA); projects coal capacity decommissioning only post-2030; envisages 80 GW of new coal under construction or planned; justified on grounds of grid reliability during renewable scale-up; draws criticism from climate advocates for extending coal horizon.

India's energy transition failure is not a renewable capacity failure — it is a systems integration failure. The country has been remarkably successful at adding solar megawatts; it has been far less successful at building the grid architecture, storage infrastructure, and policy frameworks that would allow those megawatts to displace coal reliably and safely. The April 25 peak demand record is a preview of the grid stress that will intensify every summer as climate change raises cooling loads and the share of intermittent renewables grows — the planning decisions made in the next two years will determine whether India's energy future is green or merely aspirationally green.

PRACTICE TODAY'S QUIZ

Take the 19 May 2026 Quiz →

RELATED DAILY ARTICLES

19 May Current Affairs Today — May 19, 2026

19 May IMD Yellow Alert for Delhi-NCR: 43–45°C Heatwave; SW...

18 May Current Affairs Today — May 18, 2026

17 May Current Affairs Today — May 17, 2026

← NEWER EDITORIAL
RBI Must Not Become a Fiscal Stabiliser for the Centre

OLDER EDITORIAL →
For WTO to Matter, It Needs to Recognise the Politics Behind...

CURATED & WRITTEN BY

Bharat Choudhary

UPSC Educator & Content Creator

linkedin.com/in/epicbharat

📖 Read Full Article on Ujiyari →

https://ujiyari.com/editorials/2026/05/dte-india-energy-transition-coal-storage-dilemma/