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India's Green Transition Still Runs on Coal

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INTERVIEW ANGLE

"If renewables are the cheapest source of new electricity in India, why has coal's share in actual generation barely moved — and what policy lever would you pull first to fix it?"

EDITORIAL SUMMARY:

The Hindu argues that India's non-fossil energy capacity has crossed 53.2% of installed power by March 2026 (283.46 GW out of 532.74 GW) — but coal still generated about 72% of electricity in April 2026 against just 8% from solar and wind. The gap between installed capacity and actual generation is the central decarbonisation challenge. Capacity factors, intermittency, and the near-absence of grid-scale storage mean coal continues to be the default balancing resource. The fix is not more gigawatts — it is 47 GW of battery storage and 27 GW of pumped hydro by 2030 under NEP 2023, smart grids, time-of-day tariffs, demand response, and a just transition for coal-dependent states.

CAPACITY IS NOT GENERATION

By March 2026, India's installed power generation capacity had crossed an important threshold — non-fossil sources, including large and small hydro alongside nuclear, accounted for approximately 53.2% of capacity (283.46 GW out of a total 532.74 GW). The composition is striking: about 150 GW of solar, around 56 GW of wind, about 51 GW of large hydro, around 5 GW of small hydro, about 12 GW of biomass and about 9 GW of nuclear.

The generation mix, however, tells a different story. In April 2026, coal generated about 72% of India's electricity; solar and wind together accounted for only 8%; hydro for 12%; nuclear for 3%; and the residual 5% for gas, biomass and other sources.

The 45-percentage-point gap between non-fossil installed capacity and non-fossil generation is the central decarbonisation challenge. It is not solved by adding more capacity.

WHY CAPACITY IS NOT GENERATION

The arithmetic is unsentimental. Three factors explain why coal still dispatches what renewables have nominally replaced.

Capacity Factors

A coal plant runs at a capacity factor of approximately 75% — it generates close to its rated output most hours of the year. A solar PV installation runs at a capacity factor of 22-24% — generating only during daylight, with peak output for 5-6 hours. A wind installation runs at around 25%, with seasonal concentration in the June-September monsoon months.

This means a 100 MW solar plant and a 100 MW coal plant are not equivalent — the coal plant generates roughly three times as much electricity per year as the solar plant from the same installed capacity. Gigawatt-for-gigawatt comparisons in headlines understate the dispatch reality.

Intermittency

Solar generation is concentrated in daylight hours. Wind generation is concentrated in monsoon months and in evening hours in many regions. Demand, by contrast, peaks in the evening and through the summer months. The temporal mismatch between renewable generation and electricity demand can only be resolved by storage, flexible transmission, or backup generation — and at present, the dominant backup is coal.

Dispatchability

Coal plants are dispatchable — they can be ramped up and down in response to demand signals. Renewables, in the absence of storage, are non-dispatchable. The grid operator therefore relies on coal for frequency stability, reactive power, and load following.

THE STORAGE ARCHITECTURE IS NASCENT

India's response to the capacity-generation gap is centred on storage — battery storage, pumped storage and demand-side flexibility. The architecture is in place but is at an early stage.

STORAGE TYPE	OPERATIONAL (2026)	TARGET BY 2030 (NEP 2023)
Battery Energy Storage (BESS)	~50-60 MW	47 GW
Pumped Storage Hydropower (PSH)	~4.7 GW	27 GW

The gap between operational storage and the 2030 target is wide. The policy scaffolding to close it includes:

- **National Electricity Plan (NEP) 2023, Volume I (Generation)** — set the 47 GW BESS and 27 GW PSH targets and articulated the 500 GW non-fossil capacity goal by 2030.
- **PLI ACC scheme (May 2021)** — ₹18,100 crore for advanced chemistry cell battery manufacturing, with early beneficiaries including Reliance, Ola Electric and Rajesh Exports.
- **CEA pumped storage tariff policy 2023** — gave PSH projects regulatory clarity.
- **National Framework on Energy Storage (April 2023)** — comprehensive policy framework for grid-scale storage.
- **Late Payment Surcharge Rules 2022 (LPS Rules)** — addressed discom payment delays to generators.
- **Time-of-Day tariffs (notified June 2023)** — created price signals for demand-side flexibility.
- **Green Energy Open Access Rules 2022** — enabled corporate consumers to procure renewable power directly.

Pumped storage potential in India has been estimated at about 96 GW by the Central Electricity Authority. Projects under construction include Sharavathi (Karnataka), Pinnapuram (Andhra Pradesh) and Upper Indravati (Odisha).

GRID AND DISTRIBUTION CHALLENGES

Storage alone does not solve the dispatch problem. Three system-level challenges shape the transition.

Inter-State Transmission

The Inter-State Transmission System (ISTS) faces congestion in renewable-rich regions (Rajasthan, Gujarat, Tamil Nadu) and needs investment in green-energy corridors to evacuate solar and wind power to demand centres.

Discom Finances

Aggregate Technical and Commercial (AT&C) losses are at around 15% in FY25. Discoms with weak finances cannot make long-term renewable procurement commitments or invest in storage and smart-grid infrastructure.

Frequency Stability

High renewable penetration creates frequency-stability challenges that require fast-response storage, reactive-power management, and sometimes coal-based spinning reserves. The grid operator's reliance on coal for these services is, in part, a function of the absence of alternatives at scale.

INTERNATIONAL COMPARISON

The contrast with peer economies sharpens the picture.

COUNTRY	COAL IN GENERATION	RENEWABLE IN GENERATION	GRID-SCALE STORAGE
India	~72% (April 2026)	~8% (solar+wind)	~50-60 MW BESS
China	~60%	~30%	60+ GW
United States	~16% (gas ~40%)	~22%	26 GW BESS
Germany	Coal phase-out by 2038	50%+	Significant
United Kingdom	0% (Ratcliffe-on-Soar closed 30 September 2024)	High	Growing

The UK closed its last coal plant — Ratcliffe-on-Soar — on 30 September 2024, making it the first G7 country to fully phase out coal-fired electricity. Germany has advanced its coal phase-out date from 2045 to 2038. China, even with 60% coal-fired generation, has crossed 30% renewable generation share — supported by 60-plus GW of grid storage.

India’s coal share in generation has remained stuck in the 70-75% band for five years, even as renewable installed capacity has scaled rapidly. The structural lesson is that decarbonisation is decided in dispatch, not in installation.

DEMAND-SIDE FLEXIBILITY

The grid-scale story is incomplete without the demand side.

- **Smart meters** — approximately 12 crore deployed against a 25 crore target under SAUBHAGYA and the integrated rural distribution programme.
- **Time-of-day pricing** — notified June 2023; creates price signals for shifting demand to renewable-rich hours.
- **Demand-response programmes** — flexible industrial demand, agricultural pumping, and electric-vehicle charging as load that can be shifted.
- **Vehicle-to-Grid (V2G)** — pilot projects beginning to explore EV batteries as distributed storage.

Demand-side flexibility, paired with storage, can deliver a significant share of the balancing services that coal currently provides.

COAL'S CONTINUED ROLE AND THE JUST TRANSITION

Coal is not exiting the Indian generation mix in the near term. Coal India Limited has a production target of 1 billion tonnes by FY27. The ₹37,500 crore coal-gasification scheme (approved May 14, 2026, building on the earlier ₹8,500 crore January 2024 scheme) is a parallel use-case strategy. India's net-zero commitment is by 2070 under Panchamrit (COP-26 Glasgow, November 2021), and the 500 GW non-fossil capacity target is for 2030 – both of which assume continued coal use through the transition.

The deeper question is just transition. Jharkhand, Chhattisgarh, Odisha and West Bengal depend heavily on coal mining and coal-based generation for employment and state revenues. A coal phase-down without an industrial-policy framework for these states risks regional dislocation. The just-transition framework must include retraining, alternative industrial investment, and revenue compensation.

UPSC MAINS ANALYSIS

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- **Non-fossil installed capacity share (March 2026):** 53.2% (283.46 GW out of 532.74 GW).
- **Coal share in generation (April 2026):** ~72%; solar+wind 8%; hydro 12%; nuclear 3%.
- **Capacity factors:** Coal ~75%; solar 22-24%; wind ~25%.
- **NEP 2023 storage targets by 2030:** 47 GW BESS; 27 GW pumped storage.
- **Operational storage (2026):** ~50-60 MW BESS; ~4.7 GW PSH.
- **CEA pumped storage potential:** ~96 GW.
- **PLI ACC scheme:** ₹18,100 crore; Reliance, Ola, Rajesh Exports as early beneficiaries.
- **PLI Solar:** ₹24,000 crore (Phase I ₹4,500 crore + Phase II ₹19,500 crore).
- **National Framework on Energy Storage:** April 2023.
- **Time-of-Day tariffs:** Notified June 2023.
- **Green Energy Open Access Rules:** 2022.
- **Late Payment Surcharge Rules:** 2022.
- **Smart meters:** ~12 crore deployed; 25 crore target.
- **Discom AT&C losses (FY25):** ~15%.
- **Coal India FY27 production target:** 1 billion tonnes.
- **Coal gasification scheme (May 2026):** ₹37,500 crore (cabinet approved May 14, 2026; built on earlier ₹8,500 crore scheme of January 2024).
- **Panchamrit pledges (COP-26 Glasgow, November 2021):** 500 GW non-fossil by 2030; net-zero by 2070.

- **UK last coal plant (Ratcliffe-on-Soar):** Closed 30 September 2024.
- **Germany coal phase-out:** Advanced from 2045 to 2038.

Mains Questions:

- ❶ “India’s energy transition is being decided in dispatch, not installation.” Examine.
- ❷ Evaluate the role of grid-scale storage in India’s 500 GW non-fossil target by 2030.
- ❸ Discuss the role of demand-side flexibility — time-of-day pricing, smart metering, EV charging — in India’s electricity decarbonisation.
- ❹ “A just transition for coal-dependent states is the precondition for an aggressive coal phase-down.” Discuss.

Keywords: Coal generation share, capacity-generation gap, BESS, pumped storage, NEP 2023, PLI ACC, PLI Solar, National Framework on Energy Storage, Time-of-Day tariffs, Green Energy Open Access Rules, smart meter, discom AT&C losses, Coal India 1 billion tonnes, coal gasification, Sharavathi, Pinnapuram, Upper Indravati, Panchamrit, 500 GW non-fossil, net-zero 2070, Ratcliffe-on-Soar, just transition.

The headline statistic of installed renewable capacity is the easy story to tell, and the easy story to celebrate. The harder story is the dispatch story — the kilowatt-hour that actually flows into a home, a factory or an electric vehicle, and the source from which it flowed. India’s coal share in generation has remained in the 70-75% band for five years because dispatch is decided by capacity factors, intermittency and the availability of storage — not by installed gigawatts. The next decade of India’s energy transition will be measured not in solar panels installed but in batteries deployed, pumped storage commissioned, time-of-day tariffs adopted and demand-response programmes scaled. The 500 GW non-fossil target by 2030 will mean what it should only if dispatched generation tracks installed capacity. The work of decarbonisation begins where the headline ends.

Sources: [The Hindu](#), [PRS](#), [PIB](#)

● KEY ARGUMENTS AT A GLANCE

The Hindu argues that despite non-fossil sources accounting for 53.2% of installed power capacity (283.46 GW out of 532.74 GW) by March 2026, coal still generated about 72% of electricity in April 2026 against just 8% from solar and wind — exposing that capacity additions alone do not deliver decarbonisation without grid-scale storage, flexible transmission, and demand-side

balancing. India needs system-wide transformation focused on battery storage, pumped hydro, smart grids and demand-response — not just gigawatt headlines — to genuinely decouple its electricity mix from coal and external fossil-fuel shocks.

✓ **SUPPORTING**

- Installed capacity and dispatched generation tell different stories — by March 2026, non-fossil sources (solar, wind, large and small hydro, biomass and nuclear) had crossed 53.2% of installed capacity (283.46 GW out of 532.74 GW), but in April 2026 coal still generated about 72% of electricity, with solar and wind together at only 8%, hydro at 12%, nuclear at 3% and others at 5%; the gap is driven by capacity factors — coal at around 75%, solar at 22-24% and wind at around 25%.
- Coal remains dispatch-dominant because it is base-load and 24x7 dispatchable, while solar is daytime only with 5-6 hours of peak output and wind is seasonally concentrated in the June-September monsoon months; in the absence of grid-scale storage at scale, intermittent renewables cannot be firmed and coal becomes the default balancing resource.
- India's storage architecture is still nascent — operational battery energy storage of around 50-60 MW against a target of 47 GW BESS and 27 GW pumped storage by 2030 in the National Electricity Plan (NEP) 2023; pumped storage at about 4.7 GW operational against an estimated 96 GW CEA potential; PLI ACC of ₹18,100 crore (May 2021) is scaling battery manufacturing through Reliance, Ola and Rajesh Exports; CEA tariff policy 2023, the National Framework on Energy Storage (April 2023), Late Payment Surcharge Rules 2022, Time-of-Day tariffs (June 2023) and Green Energy Open Access Rules 2022 are the policy scaffolding.
- International comparison is instructive — China is at coal 60% and renewable 30% of generation with 60-plus GW of storage; the US is at gas 40%, coal 16%, renewables 22% with 26 GW of BESS; Germany has crossed 50% renewable generation with a 2038 coal phase-out; the UK retired its last coal plant (Ratcliffe-on-Soar) on 30 September 2024 — while India's coal share in generation has been stuck at 70-75% for five years even as renewable capacity has scaled.

⚠ **COUNTER**

A counter-reading holds that coal's continued dominance is a transitional necessity — that base-load reliability, affordable power for industry, and the just-transition obligations to coal-dependent states (Jharkhand, Chhattisgarh, Odisha, West Bengal) make a faster

phase-out politically and economically costly, and that India's net-zero by 2070 commitment under Panchamrit (COP-26 Glasgow, November 2021) does not require an aggressive near-term coal exit. This view risks under-pricing the long-term cost of locking in coal infrastructure and missing the storage and grid-investment window.

→ WAY FORWARD

Deliver 47 GW of battery storage and 27 GW of pumped storage by 2030 under NEP 2023 with viability gap funding, accelerate Sharavathi, Pinnapuram and Upper Indravati pumped storage projects, expand smart-meter deployment (target 25 crore) with time-of-day pricing and demand-response programmes, invest in inter-state transmission to relieve ISTS congestion, fund a just-transition framework for coal-dependent states, scale the PLI ACC (₹18,100 crore) and PLI Solar (₹24,000 crore across Phase I and II) to secure domestic manufacturing, and use the National Framework on Energy Storage and Green Energy Open Access Rules to integrate corporate RE procurement with storage.

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MAINS ANSWER FRAMEWORK

QUESTION

"Despite non-fossil sources crossing 53% of installed capacity, coal continues to dominate India's electricity generation." Examine the capacity-generation gap, the role of grid-scale storage, and suggest a way forward to decouple India's electricity mix from coal. (250 words)

INTRODUCTION

The Hindu argues that India's non-fossil capacity has crossed 53.2% of installed power by March 2026 (283.46 GW out of 532.74 GW), but coal still generated about 72% of electricity in April 2026 — exposing that capacity additions alone do not deliver decarbonisation without storage, grid flexibility and demand-side balancing.

BODY

The capacity-generation gap is structural. Coal runs at a capacity factor of around 75% and is 24x7 dispatchable; solar runs at 22-24% with daytime output only; wind runs at around 25% with monsoon

concentration.

In the absence of grid-scale storage at scale, coal becomes the default balancing resource. India's storage architecture is still nascent — about 50-60 MW of operational battery storage against a National Electricity Plan 2023 target of 47 GW BESS by 2030; about 4.7 GW of pumped storage against a CEA potential of about 96 GW. The policy scaffolding is in place — the PLI ACC scheme of ₹18,100 crore (May 2021) scaling battery manufacturing through Reliance, Ola and Rajesh Exports; the CEA pumped-storage tariff policy 2023; the National Framework on Energy Storage (April 2023); Late Payment Surcharge Rules 2022; Time-of-Day tariffs notified June 2023; and Green Energy Open Access Rules 2022.

Smart-meter deployment is at around 12 crore against a 25 crore target under SAUBHAGYA and the integrated rural distribution programme. International benchmarks are sobering — China has 60-plus GW of storage, the US has 26 GW of BESS, Germany has crossed 50% renewable generation, and the UK retired its last coal plant (Ratcliffe-on-Soar) on 30 September 2024 — while India's coal share in generation has been stuck at 70-75% for five years.

CONCLUSION

The way forward is system-wide transformation — deliver 47 GW BESS and 27 GW pumped storage by 2030 with viability gap funding; accelerate Sharavathi, Pinnapuram and Upper Indravati pumped storage; expand smart metering, time-of-day pricing and demand-response; invest in inter-state transmission; fund a just-transition framework for Jharkhand, Chhattisgarh, Odisha and West Bengal; and use NEP 2023, Green Energy Open Access Rules and PLI Solar (₹24,000 crore) to integrate RE procurement with storage. The 500 GW non-fossil capacity by 2030 target under Panchamrit is meaningful only if dispatched generation tracks installed capacity.

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