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Record renewables capacity in FY24-25 signals India's path beyond coal

Key findings

- India has 32.3 GW of thermal capacity under construction and 23.55 GW of stressed capacity. If all these are commissioned, total coal capacity would rise from 215 GW to 271 GW, which is higher than projected installed capacity requirements, indicating that existing and under-construction capacity is sufficient to meet future demand.
- In FY 2024-25, the 230 GW peak demand met was crossed only in 60 days, compared to none in FY 2023-24. The number of days with demand below 200 GW dropped from 116 to 37. Despite this rise, overall demand remains within the operational range of the existing generation fleet.
- In FY 2023-24, 305 out of 366 days saw their daily peak during solar hours. In FY 2024-25, this number was 256 out of 365. Peak demand during non-solar hours remained significantly lower, rising from 210.64 GW to 224.18 GW. These levels are well within the capacity of the existing and under-construction thermal, hydro, and other dispatchable sources.
- On 30 May 2024, India recorded its highest-ever electricity demand at 250 GW, during solar hours with 0.1 GW shortage. Only 188.24 GW of thermal capacity was online, with the remainder offline due to maintenance or forced outages. This demonstrates that even peak loads can be met without utilising the full coal fleet, largely due to strong solar generation, which can contribute over 60 GW during daylight hours.

- On peak demand days, the share of renewable energy (solar, wind, and biomass) in total gross generation increased from 9% in FY 2023-24 to 15% in FY 2024-25. The share of coal and lignite remained steady, declining slightly from 71% to 70%.
- India currently has 234 GW of renewable energy capacity in the pipeline, which will further reduce pressure on thermal resources as solar continues to dominate during peak hours.

Introduction

India's power sector stands at a critical juncture, marked by record-high installed capacity and a rapidly evolving energy mix. With a total installed power capacity of over 475 GW, the country continues to rely heavily on coal, yet the momentum behind renewable energy has never been stronger. Recent years have seen unprecedented growth in solar and wind installations, alongside steady contributions from large hydro and other sources. At the same time, the sector faces important questions about the future role of coal, the pace of capacity additions, and the reliability of supply as electricity demand continues to rise.

This brief examines the current status of India's power generation landscape, recent trends in capacity addition and retirement, the shifting balance between different energy sources, and the implications for meeting future demand.

Installed capacity

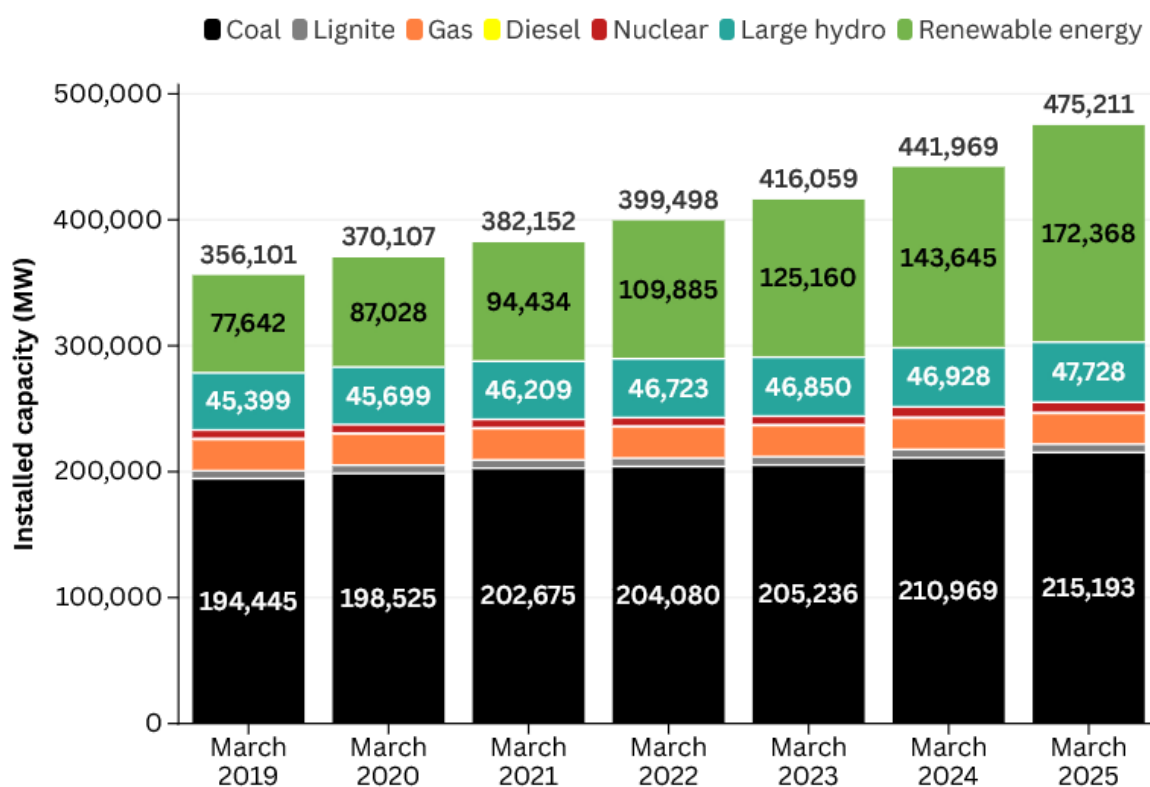
As of March 2025, the total installed power capacity in India stands at 475.21 GW. Among the various energy sources, coal continues to dominate the energy mix, contributing about 215.19 GW, which accounts for 45.28% of the total installed capacity. Renewable energy sources (excluding large hydro) collectively contribute 172.37 GW, making up 36.27% of the total capacity. Large hydro power adds another significant share of 47.73 GW, or 10.04%. Other sources such as gas, nuclear, lignite, and diesel contribute smaller portions, with gas at 24.53 GW (5.16%), nuclear at 8.18 GW (1.72%), lignite at 6.62 GW (1.39%), and diesel at 0.59 GW (0.12%).

Within the renewable energy sector, solar power is the dominant source with a capacity of 105.65 GW, accounting for 61.29% of the total renewable capacity. This figure [comprises](#) 81.01 GW from ground-mounted installations, 17.02 GW from rooftop solar, 2.87 GW from

solar components of hybrid projects, and 4.74 GW from off-grid systems. Wind power has surpassed the 50 GW milestone, reaching 50.04 GW and making up 29.03% of the total renewable energy capacity. Biomass and other sources contribute 10.74 GW (6.23%), while small hydro power adds 5.10 GW (2.96%).

India's total installed power capacity is distributed across three main sectors: State, Private, and Central. The Private sector leads with 257.18 GW, followed by the State sector at 111.66 GW, and the Central sector at 106.37 GW.

All India installed capacity



Source: CEA

In the Central sector, coal also leads with 69.34 GW (65.19%), followed by large hydro at 16.34 GW (15.36%), nuclear at 8.18 GW (7.69%) and gas at 7.24 GW (6.80%). Lignite contributes 3.64 GW (3.42%), and renewables represent a relatively minor portion at 1.63 GW (1.53%).

In the State sector, coal dominates with 72.76 GW, accounting for 65.16% of its capacity. Large hydro power is the next significant contributor at 27.45 GW (24.59%), while gas contributes 7.38 GW (6.61%). Renewables make up a modest 2.63 GW (2.36%), with lignite and diesel contributing minor shares.

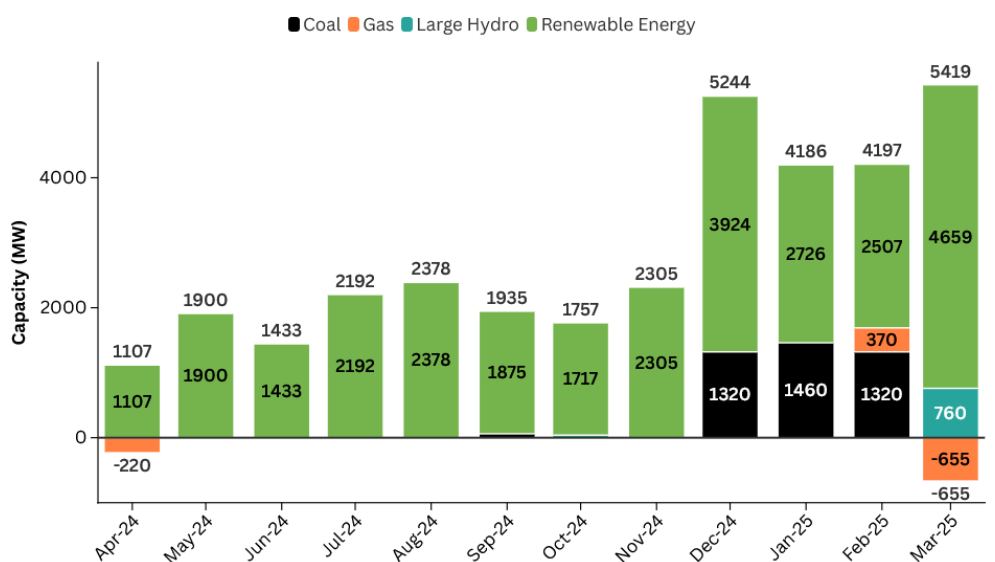
The Private sector's capacity mix is notably different, with renewables as the largest contributor at 168.10 GW, making up 65.36% of the total. Coal follows at 73.10 GW (28.42%), while gas (9.91 GW, 3.85%), large hydro (3.93 GW, 1.53%), lignite, and diesel play smaller roles. Although the Private sector's coal capacity is higher than that of both the State and Central sectors, its much larger renewable capacity means that renewables have overtaken coal as the dominant energy source within this sector.

Overall, the Private sector is driving renewable energy expansion, while State and Central sectors remain dominated by coal and large hydro power.

Capacity addition and retirement

During the financial year 2024-25, India added a total of 34.05 GW of new power generation capacity. The largest share of this addition came from the renewable energy category, which contributed 28.72 GW, accounting for 84.35% of the total new capacity. Coal followed with an addition of 4.16 GW (12.22%), while large hydro sources added 0.80 GW (2.35%). Gas based projects contributed 0.37 GW (1.09%) to the new capacity, and there was no new capacity added from other sources.

Capacity addition and retirement in FY 2024-25



Source: CEA

Note: Negative values indicate capacity retirement and positive values indicate capacity additions



This 28.72 GW addition in renewables during FY 2024-25 represents a significant surge, marking the highest annual increase to date. It reflects a sharp acceleration compared to previous years, which saw additions of 18.48 GW in FY 2023-24, 15.27 GW in FY 2022-23, and 15.45 GW in FY 2021-22. The data clearly shows that after a period of relatively steady but moderate growth, renewable energy installations began to pick up momentum from FY 2021-22 onward, resulting in a record-breaking addition in FY 2024-25.

In the financial year 2024-25, India added 4.53 GW of new thermal power (coal and gas combined) capacity. This follows a notable increase in thermal additions in FY 2023-24, when 5.40 GW was added, the highest in the past four years. Looking at the recent trend, thermal capacity additions have been declining steadily from 6.77 GW in FY 2019-20 to just 1.46 GW in FY 2022-23. However, beginning in FY 2023-24, there has been a clear revival, with annual additions rising again. This uptick in the last two years signals renewed investment and momentum in thermal power expansion after a period of slowdown. Importantly, with the government proposing to add [100 GW](#) of new coal-based capacity by 2032, coal power additions are expected to scale up significantly in the coming years.

On the retirement side, the only significant change was in gas-based power, with 0.88 GW retired, making up 100% of the total retired capacity for the 2024-25 year. No capacity was retired from coal, large hydro, renewable energy, or other sources.

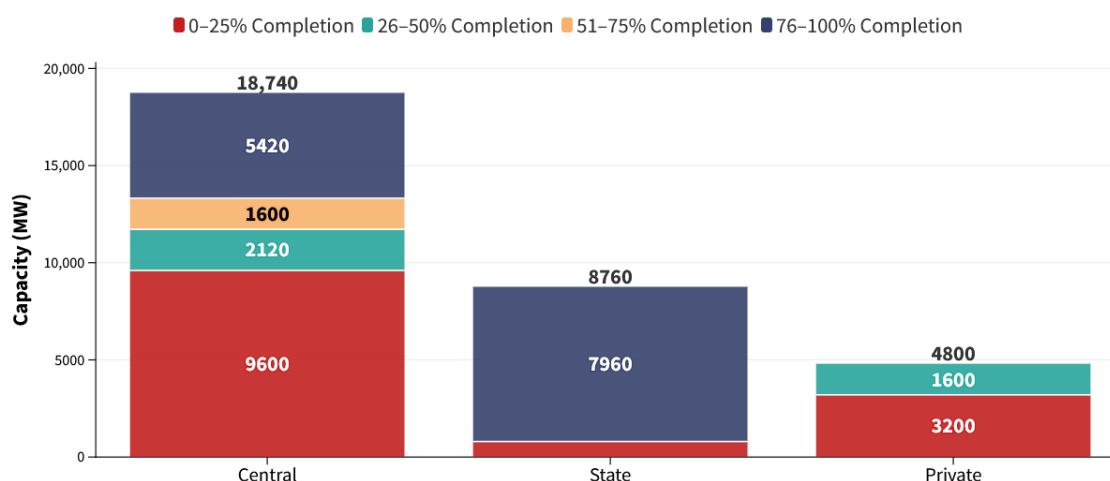
Under construction and work on hold

India has 32.3 GW of thermal capacity under construction, distributed across 18.74 GW in the Central Sector, 8.76 GW in the State Sector, and 4.8 GW in the Private Sector. Looking ahead, India [plans](#) to add substantial thermal power capacity over the next several years, with the highest target set for FY 2025-26 at 12.86 GW. This is followed by a 2.92 GW addition in FY 2026-27, then 5.32 GW in FY 2027-28, 4 GW in FY 2028-29, 6.4 GW in FY 2029-30, and a final 0.8 GW planned for FY 2030-31.

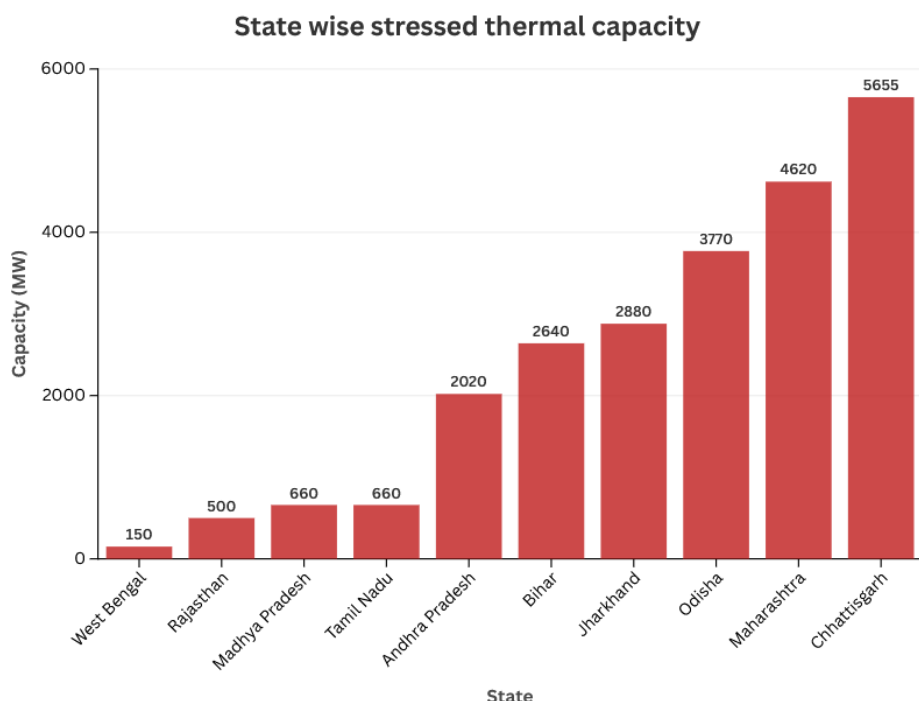
In the financial year 2025-26, a total of 12.86 GW of power generation capacity is anticipated to be ready for trial runs across several states in India. Telangana leads with 3.20 GW, followed by Uttar Pradesh with 2.64 GW, Jharkhand with 2.26 GW. Tamil Nadu is expected to add a combined 2.12 GW from two projects, while Bihar will contribute 1.98 GW. West Bengal is also set to see 0.66 GW of new capacity ready for trial in the same period.

In addition, a significant number of under construction coal-fired power plants where work is on hold or not likely to be commissioned (stressed capacity) account for a total of 23.55 GW (0.5 GW in the Central Sector and 23.05 GW in the Private Sector).

Sector-wise coal-based electricity generation capacity under construction in India



Source: CEA



Source: CEA



Electricity demand

In FY 2024-25, the peak demand met reached 250.1 GW, marking a 4.2% increase over the previous year. This figure closely matched the total peak demand, including unmet demand, which was 250.2 GW, indicating that the gap between demand and supply had significantly narrowed to just 0.1 GW (118 MW) of unmet demand. In comparison, FY 2023-24 recorded a higher total peak demand of 250.7 GW, with only 240 GW being met, resulting in a substantial shortfall of 10.7 GW. The sharp rise in demand during the previous year had placed considerable strain on the grid. The moderation in peak demand this year may be linked to an overall slowdown in the industrial sector.

On the peak demand day, the contribution of renewable energy sources (solar, wind, and biomass) in total gross generation increased from 9% in FY 2023-24 to 15% in FY 2024-25. Meanwhile, the shares of coal and lignite remained relatively steady, slightly declining from 71% to 70%, while nuclear and gas-based sources remained constant at 2% and 4%, respectively. However, the share of hydropower dropped from 14% to 9%, with the higher

share in FY 2023-24 reflecting the generation during the monsoon season, when reservoir levels are typically high, and the lower share in FY 2024-25 corresponding to the dry season when reservoir levels are lower.

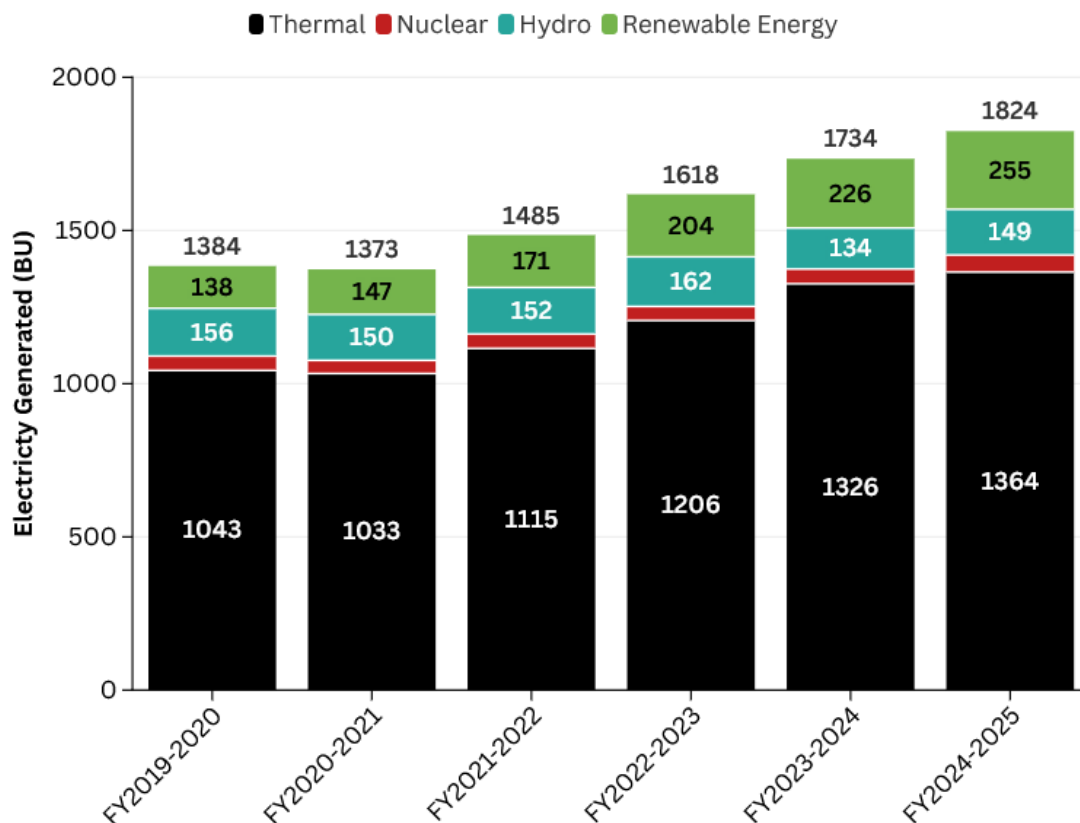
Electricity generation

India's electricity generation in FY 2024-25 reached a new high of 1824 billion units (BU), continuing the upward trajectory since the pandemic-related slump. This represents a 5% YoY growth over the 1734 BU generated in FY 2023-24. The pace of growth has begun to moderate, as FY 2023-24 saw a 7% increase, and the year prior experienced a sharp 9% rise.

In FY 2024-25, electricity generation grew across all sources. Thermal generation rose by 2.8% (from 1326 BU to 1364 BU), nuclear generation increased by 18.4% (from 48 BU to 57 BU), large hydro grew by 10.8% (from 134 BU to 149 BU), and renewables saw an increase of 11.4% (from 226 BU to 252 BU).

However, thermal power generation recorded the slowest YoY growth among all major sources, rising by only 2.8%. This marked a significant slowdown compared to the previous three years, when thermal power had consistently seen higher increases of 8.2%, 9.9%, and 7.96%, respectively. In contrast, nuclear, large hydro, and renewable energy saw stronger growth, with nuclear increasing by 18.4%, large hydro growing by 10.8%, and renewables rising by 11.4%. Consequently, all generation sources, except thermal, demonstrated stronger growth compared to the previous year.

Electricity generated by source



Source: NPP, CEA

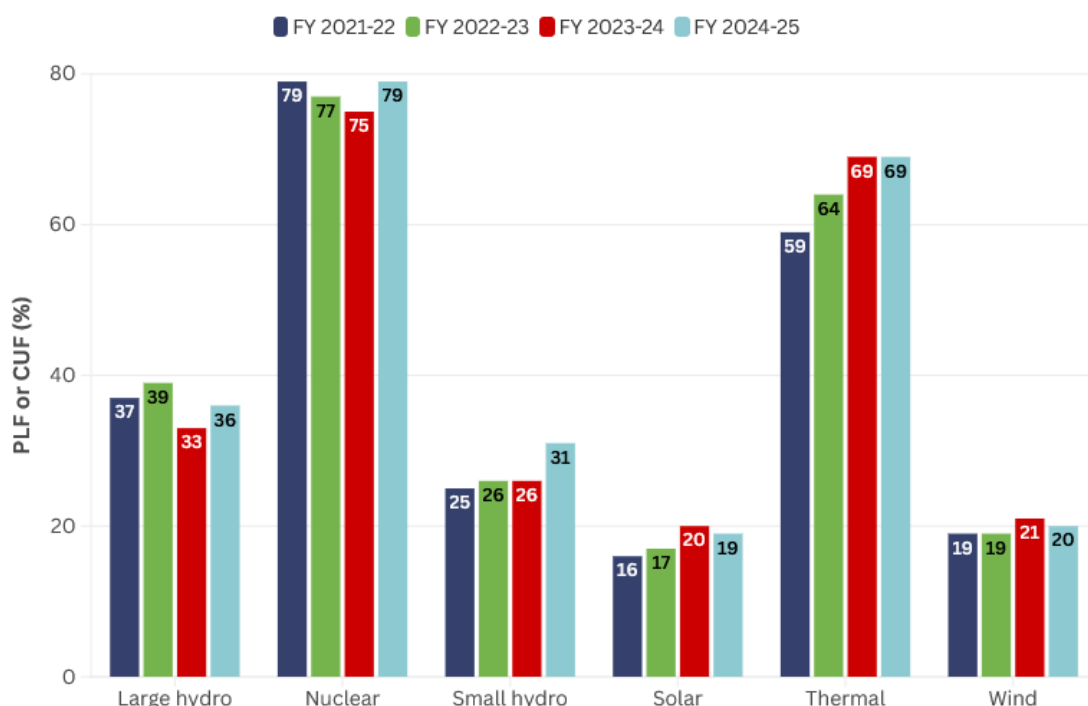


Plant load factor

The Plant Load Factor (PLF) – or the amount a power plant is used in relation to its total capacity – across India's power generation sectors in FY 2024-25 showed varied performance compared to FY 2023-24. In FY 2024-25, the thermal sector's PLF remained largely stable, with a slight increase from 69.09% in FY 2023-24 to 69.45% in FY 2024-25. This marks a consistent, gradual improvement from previous years. The PLF for thermal power has shown a steady upward trajectory over the past few years, rising from 59% in FY 2021-22 to 64% in FY 2022-23 and then to 69% in FY 2023-24. The continuation of this positive trend reflects better utilization of existing thermal capacity.

In contrast, the Capacity Utilisation Factor (CUF) – or how much energy a plant actually generates compared to its maximum possible output over a given time period – for solar slightly declined from 20.33% in FY 2023-24 to 19.16% in FY 2024-25, and for wind, it decreased from 20.86% to 19.65% during the same period. However, it is important to note that the CUF for solar has significantly improved over the past few years, as it was only 16% in FY 2021-22, reflecting substantial progress in both capacity addition and operational efficiency. Similarly, wind CUF, which stood at 19% in FY 2021-22, has remained consistent, with only a slight fluctuation in recent years.

PLF/CUF of electricity generation sources in India



Source: NPP, CEA



Large hydro PLF, which was 37.2% in FY 2021-22, increased slightly to 39.5% in FY 2022-23, before declining to 32.61% in FY 2023-24 and further rising to 35.55% in FY 2024-25. This fluctuation in performance is likely due to variations in seasonal water availability and reservoir levels, which impact hydro generation.

Nuclear PLF has remained relatively stable over the past few years, with a slight decrease from 79.32% in FY 2021-22 to 77.22% in FY 2022-23. However, it improved to 74.7% in FY

2023-24, and further rose to 79.1% in FY 2024-25, reflecting a return to higher operational efficiency.

Small hydro PLF has shown a consistent upward trend, rising from 24.63% in FY 2021-22 to 25.79% in FY 2022-23, then increasing further to 25.83% in FY 2023-24, and 30.97% in FY 2024-25.

Shifting currents: Navigating beyond coal in India's power mix

The government's plan to raise the coal based power capacity target to [100 GW](#) over the next seven years, up from the earlier 80 GW, reflects an intent to meet India's growing electricity demand. Notably, [22.6 GW](#) of new coal capacity was already awarded during FY 2024-25, signaling rapid progress toward this target. This marks a significant increase in ambition for thermal expansion. However, when viewed alongside India's evolving power demand patterns and its accelerating clean energy transition, questions naturally arise about whether such a scale of coal-based capacity addition is warranted.

India's electricity system is already undergoing a structural transformation. In FY 2024-25, despite strong economic activity and rising consumption, the national grid crossed the 230 GW demand threshold in only 60 days, with just one day on 30 May, 2024 exceeding 250 GW. In FY 2023-24, the system never breached 240 GW. Meanwhile, the number of days with demand below 200 GW fell from 116 in FY 2023-24 to just 37 in FY 2024-25, signaling a clear shift toward a higher base demand. However, even with this shift, the demand remains within the operational bandwidth of the current generation fleet.

On 30 May 2024, the day of maximum demand at 250 GW, the peak occurred during solar hours, and only 188.24 GW of thermal capacity was online for generation. The rest was offline due to planned maintenance (2.48 GW), forced outages (15.76 GW), or other maintenance (4.4 GW). This highlights the system's ability to meet even peak loads without utilising the full coal fleet, thanks in part to solar generation during daytime hours. Indeed, solar power alone is capable of contributing up to [60 GW](#) and above during solar hours, significantly reducing pressure on thermal resources during daytime peaks. India also has [234 GW](#) of renewable energy in the pipeline and is targeting [500 GW](#) of non-fossil capacity by 2030. To meet the 500 GW goal, the government has declared a plan to add [50 GW](#) of

renewable energy capacity annually till 2027-28, further strengthening the case for meeting future demand without major new coal additions.

Table: Categorizing days in fiscal year based on demand met

Demand met (GW)	# Days in FY 23-24	# Days in FY 24-25
<200	116	37
200-210	97	100
210-220	112	95
220-230	32	73
230-240	9	54
240-250	0	5
>250	0	1

India also has 234 GW of renewable energy capacity (including large hydro) in the pipeline. Over the past two fiscal years, all but one month (December 2024) saw monthly peak demand during non-solar hours. In FY 2023-24, 305 out of 366 days recorded their daily peak during solar hours. In FY 2024-25, that number was 256 out of 365 days. Peak demand during non-solar hours was considerably lower, maxing out at 210.64 GW in FY 2023-24 and 224.18 GW in FY 2024-25. These non-solar demands are well within the range of what the existing and under-construction thermal capacity can handle, especially when combined with hydro and other dispatchable sources.

A recent [study](#) shows that India can meet its projected electricity demand by 2030 without adding any new coal capacity, if it achieves a 600 GW non-fossil target (377 GW solar, 148 GW wind, 62 GW hydro, 20 GW nuclear). Even under faster-than-expected demand growth, this high-renewables pathway remains the most cost-effective. It would reduce power procurement costs while eliminating the need for new coal plants.

However, realizing this scenario hinges on complementary investments: energy storage, transmission upgrades, and enhanced grid coordination. Another [study](#) finds that if battery storage costs decline by 15% annually, India can cap coal capacity at 260 GW by 2030, as planned in the National Electricity Plan, avoiding new coal entirely. Even with slower (7%) storage cost declines, coal use would plateau, and only limited additional capacity may be needed to manage non-solar peaks. Renewables, even with integration and balancing costs, have already become [cheaper](#) than coal-based generation, reducing reliance on costly thermal plants.

Conclusion

The 20th [Electric Power Survey](#) projects a peak demand of 366 GW in 2031-32. According to the [National Electricity Policy](#), coal and lignite installed capacity is estimated at 254.6 GW under a conservative scenario and 262.6 GW for a higher demand scenario. The CEA's [optimal energy mix](#) projects an all-India peak demand of 334.8 GW in 2029-30, with a coal capacity of 251.68 GW. Currently, India has 32.3 GW of thermal capacity under construction and 23.55 GW of stressed capacity. If all these are commissioned, total coal capacity would rise from 215 GW to 271 GW, which is higher than projected installed capacity requirements, indicating that existing and under-construction capacity is sufficient to meet future demand. Rather than adding more coal plants and risking stranded assets, India's energy future is better secured by accelerating renewables, upgrading the grid, expanding storage, and enhancing flexibility in the existing thermal fleet.