Energy Sufficiency of India and It's States

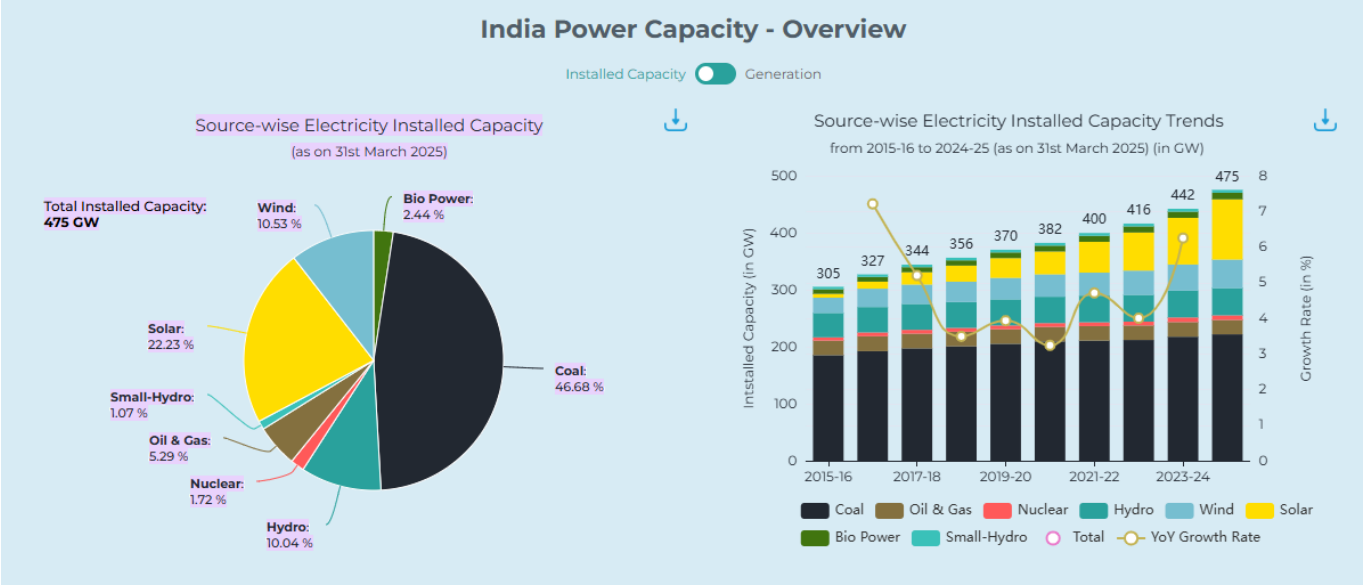
Mains Syllabus: GS III - Infrastructure: Energy.

Why in the News?

Recently Union Power Minister informed the parliament that India has been transformed from a power deficit to a power sufficient nation in past ten years.

What is the energy status of India?

- **India's Power Capacity** - India's total cumulative power generation capacity reached 475.2 gigawatts (GW) as of March 31, 2025.



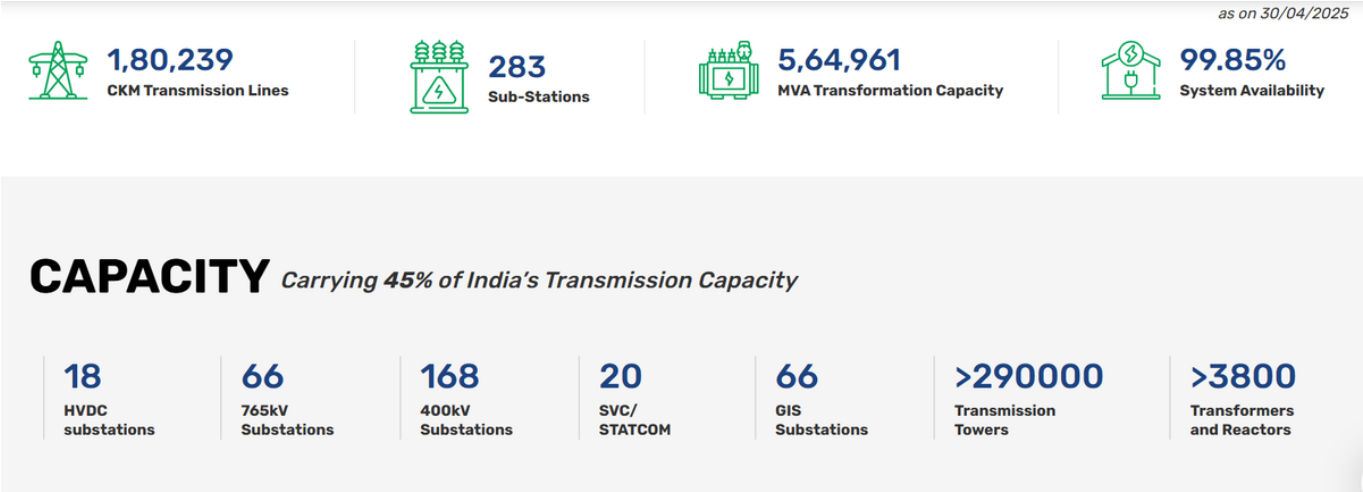
- **Expansion in the last decade** - An addition of 238 GW in generation capacity since April 2014 spanning 2,01,088 circuit kilometers (ckm) of transmission lines has helped to boost inter-regional transferring capacity to 1,18,740 MW.
- **Reduction in Energy Gap** - In the past four years, the gap between the energy demand and capacity has fallen to 0.1%.
- **Increase of Renewable Energy** - The contribution of renewable energy as a percentage has gradually increased from 11.5% in 2021-22 to 13.78% in 2024-2025.

How is power transferred between States?

- **Regional Power Grids** - India's States are divided into five regional power grids – North, East, West, South and North-East.
- **Inter-Regional Grid Connection** – It was first accomplished in 1991 when the East

and North-Eastern grids were connected and the West followed in 2003 and the North in 2006.

- **National Power Grid** – It was established after the South was synchronously interconnected with the commissioning of the 765 kilo Volt (kV) Raichur-Solapur transmission line in 2013
- It has ensured that the entire nation was operating at one frequency – 50 Hertz (Hz).
- The archipelagos of Lakshadweep and Andaman & Nicobar, which are far away from the Indian mainland, are not connected to the national grid.
- **Load Dispatch Centers** - As part of its national grid operations, PGCI manages the national load dispatch centre (NLDC), five regional load dispatch centres (RLDC) and State load dispatch centres (SLDC), monitoring the power flow across States.
- These centres interact with the dispatch centres of private power companies to monitor and regulate their power flow too.



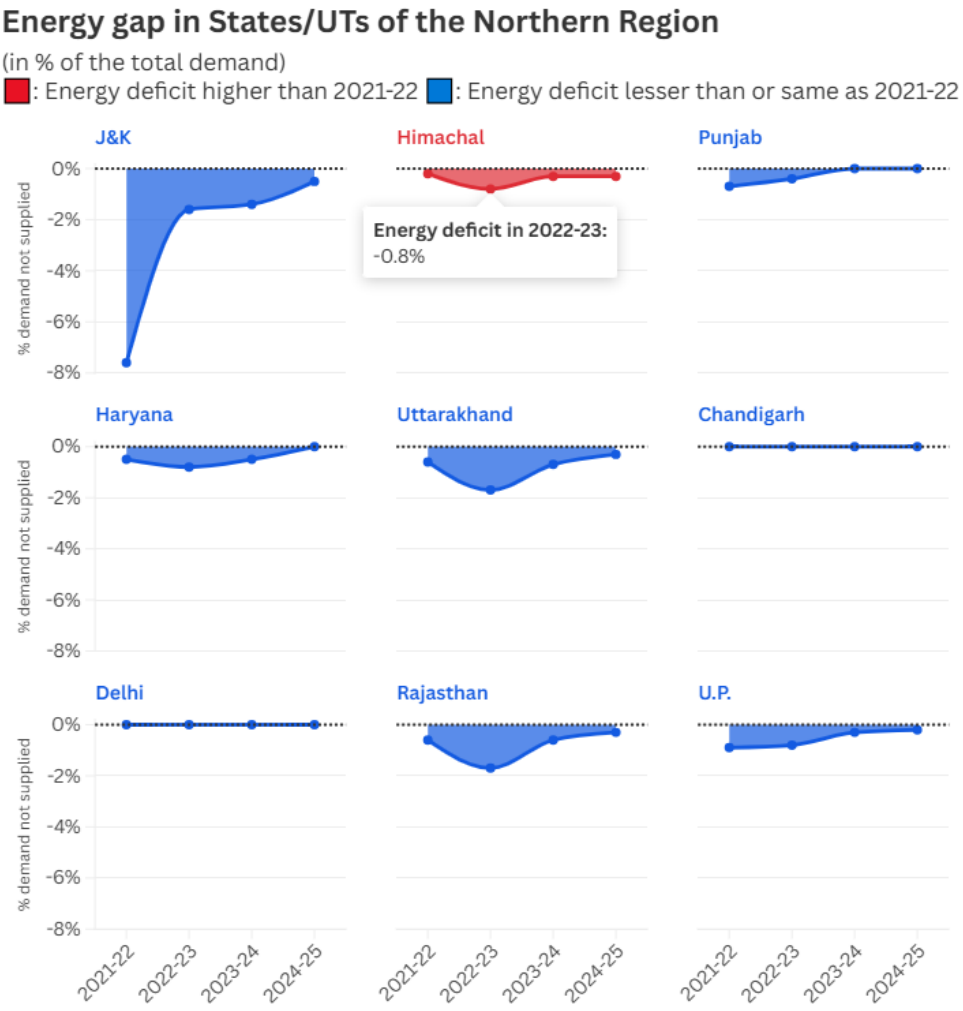
- **Private Dispatch Centers** - While the Power Grid is the central transmission utility in India (and the largest), private companies like Adani Transmission, Tata Power, Sterlite Power, and ReNew Power too have their own network and load dispatch centres which are connected to the SLDCs.

Functions of Power Grid Corporation of India
• **Nodal Agency** - National Grid is maintained by the government-run Power Grid Corporation of India Ltd (the Power Grid) to monitor, regulate and facilitate inter-State power flow. • **Power Transmission** - Overall, the Power Grid carries 45% of India's transmission capacity via its large network of transmission towers, substations of varying voltages, satellite communication, transformers and reactors. • **Electricity Trade Monitoring** - The Power Grid also oversees power trading between various power entities, States and regions. • **Integration of Renewable Energy** – It is responsible for integrating power produced by renewable energy sources with the National Grid. • **International Power Transfer** – The Power Grid facilitates power transfer between India and Bhutan, Nepal, Myanmar, and Bangladesh.

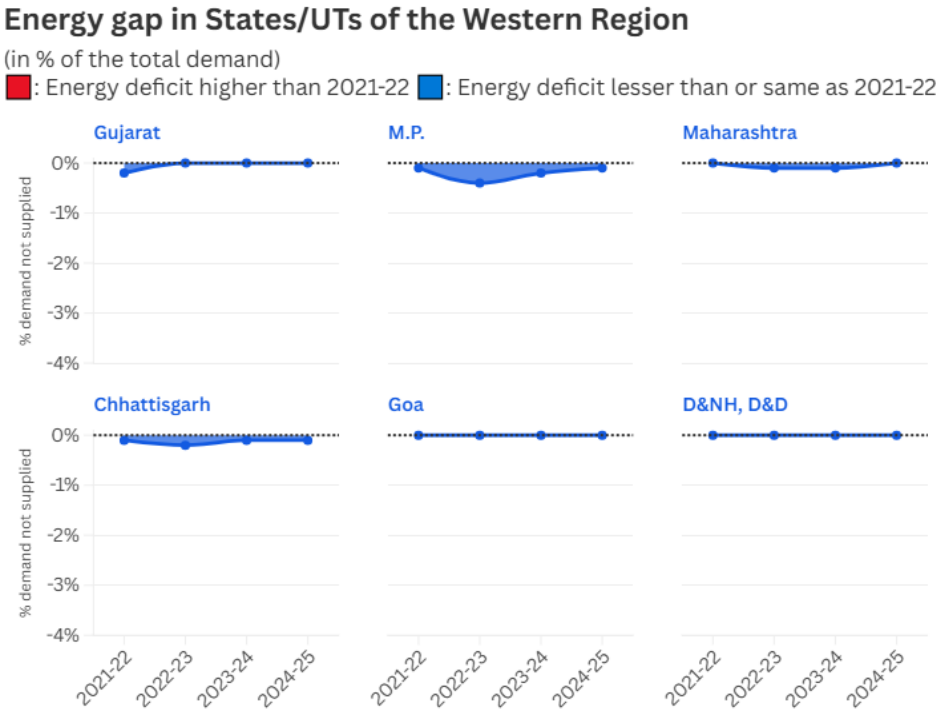
How are States bridging the power gap?

- **Reduction in North Grid** - Comprising of Uttar Pradesh, Uttarakhand, Rajasthan,

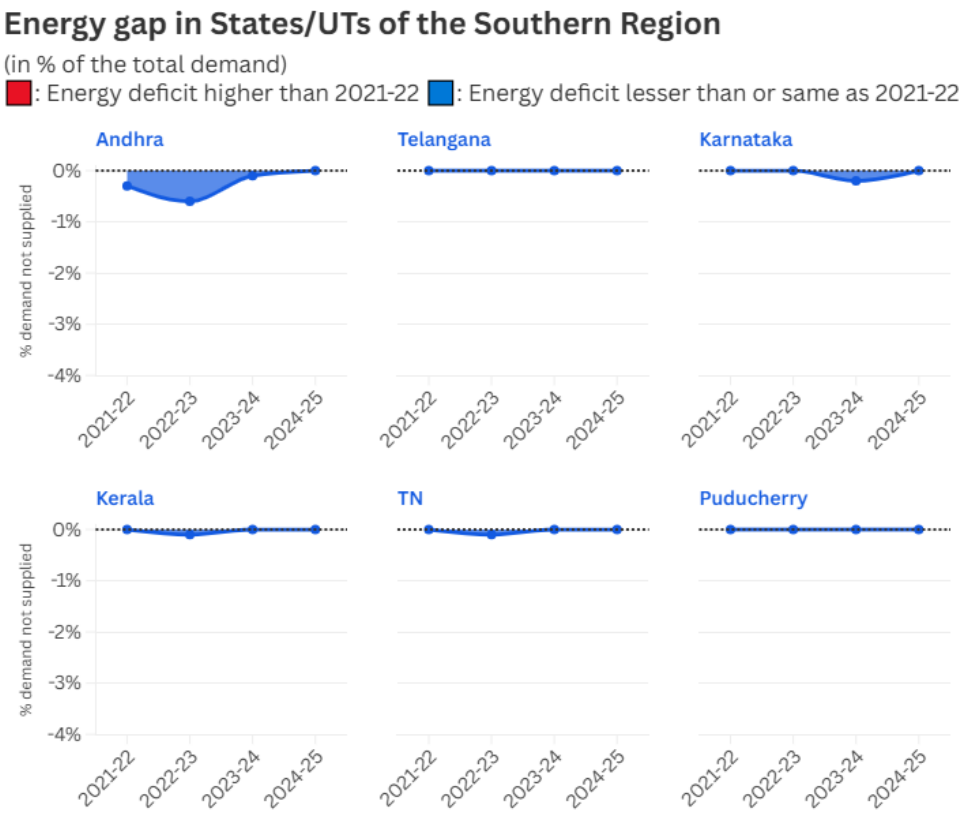
Punjab, Jammu-Kashmir, Himachal Pradesh, Haryana, Delhi and Chandigarh, in the North has consistently reduced from 1% from 2021-22 to 0.2% in 2024-2025.



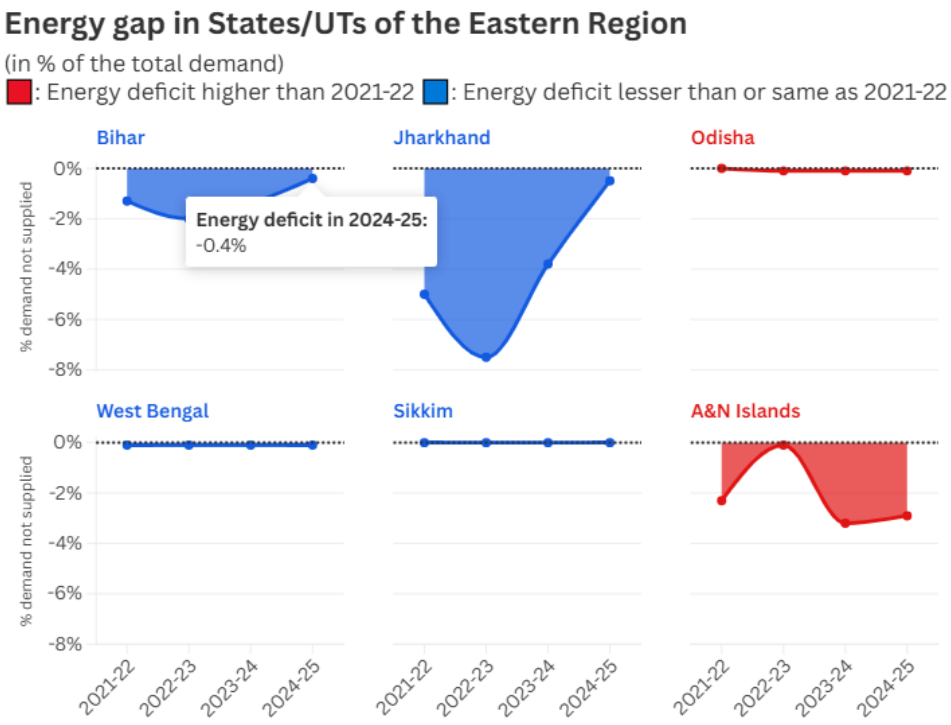
- **South & West** - These two regions which cover India's largest power consuming states like Maharashtra, Gujarat, Tamil Nadu, Madhya Pradesh and Telangana, have managed to keep their energy gap limited to 0.1% through the years.



- **South** – The region with Tamil Nadu, Karnataka, Andhra Pradesh, and Telangana have large power requirements, ballooned from 3,50,672 MU in 2021-22 to 4,19,531 MU in 2023-24.

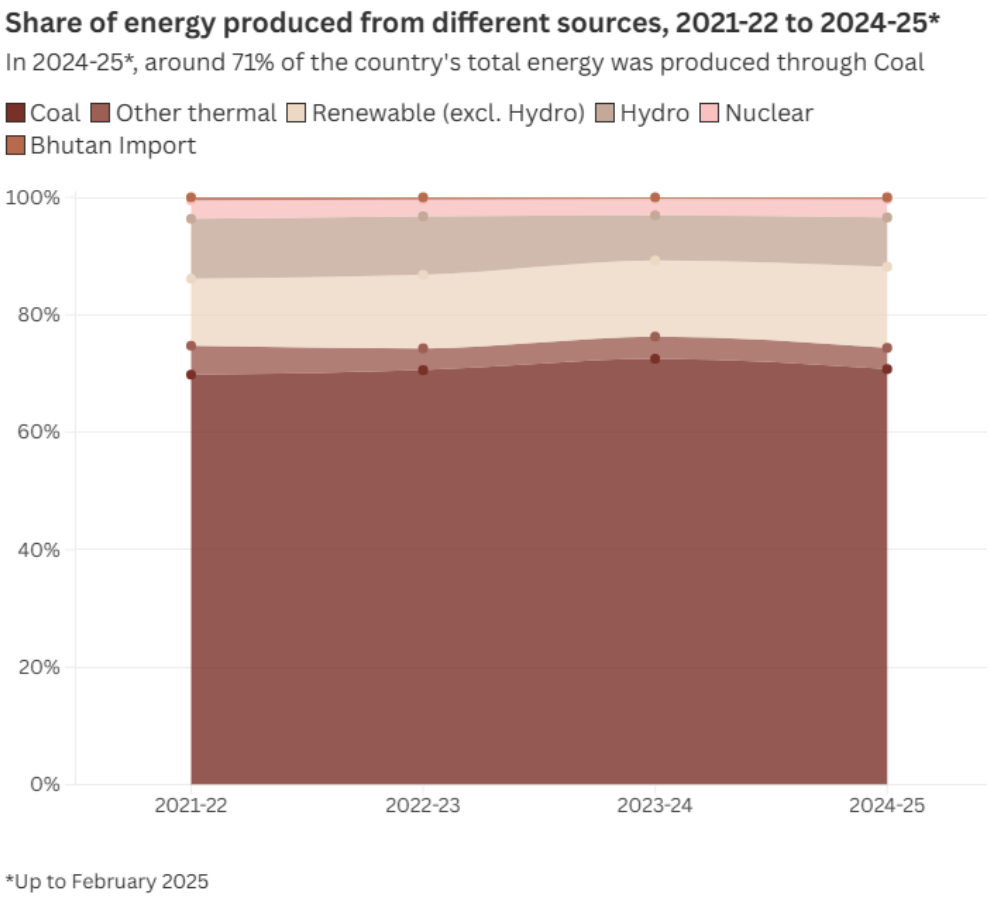


- **East & North-East** - Despite it being one of the first regions to get an interconnected grid, East grid's States like Bihar and Jharkhand have been unable to meet their power demands.



What are the measures to taken to reduce the energy gap?

- **Expansion of Transmission of Lines** - According to the Power Ministry's annual report 2024-25, India has added 14,360 ckm this year, enhancing the country's transformation capacity and interregional capacity of 2200 MW.
- **Addition of Extra-High Voltage (EHV) lines** – Six EHV lines of voltages above 400 kV, have been commissioned through the year in Uttar Pradesh, Rajasthan, Karnataka, Maharashtra, Assam and Meghalaya.
- **Increase in Renewable Energy** - Centre revealed that in the past four years, renewable energy production has increased from 1,70,912 MU in 2021-22 to 2,30,867 MU in 2024-25.
- Rajasthan has almost doubled its capacity from 24,099 MU to 50,322 MU, followed by Gujarat which added 15,644 MU in this time.



What lies ahead?

- With India's plan to boost its non-fossil energy capacity to 500 GW by 2030, the Centre needs to install the transmission system needed to evacuate the power.
- Interstate transmission networks for the evacuation of 161.9 GW of the installed capacity of 209 GW of renewable energy are under construction.
- Transmission systems for delivery of power to the Green Hydrogen/Green Ammonia Manufacturing hubs at Mundra, Kundla, Gopalpur, Paradeep, and Vizag are under planning.
- Public or private investment upto ₹9.15 lakh crore is needed in the transmission sector to realise the Centre's plan.

Reference

[The Hindu | How energy sufficient are India and its States?]