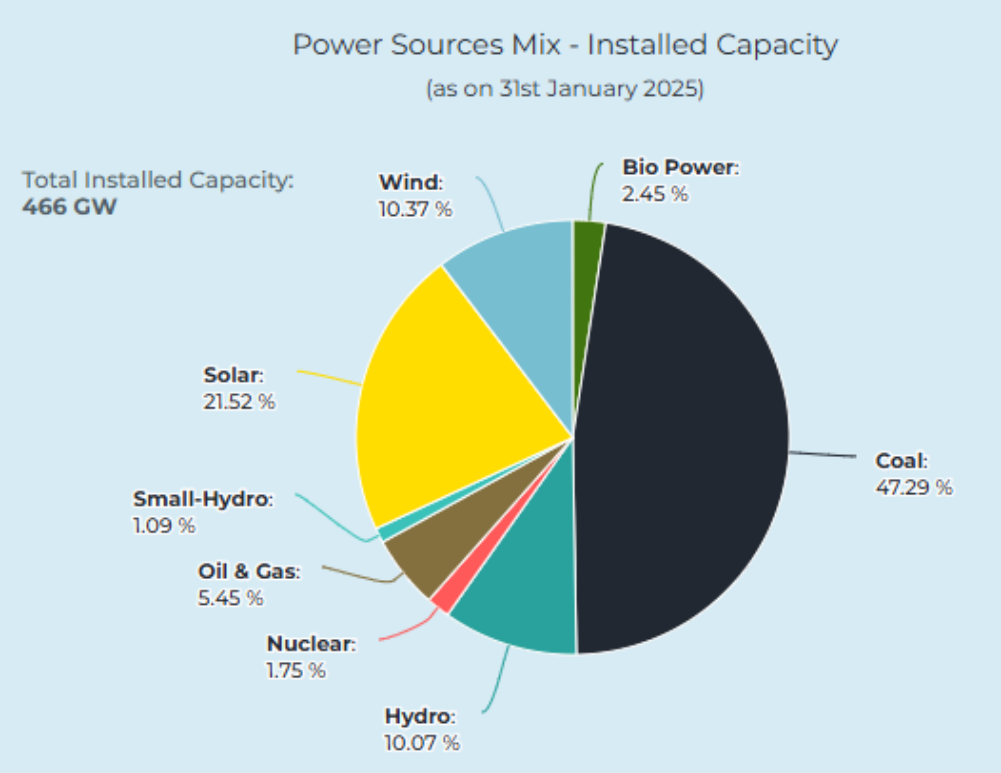
Renewable Energy in Meeting Electricity Demand

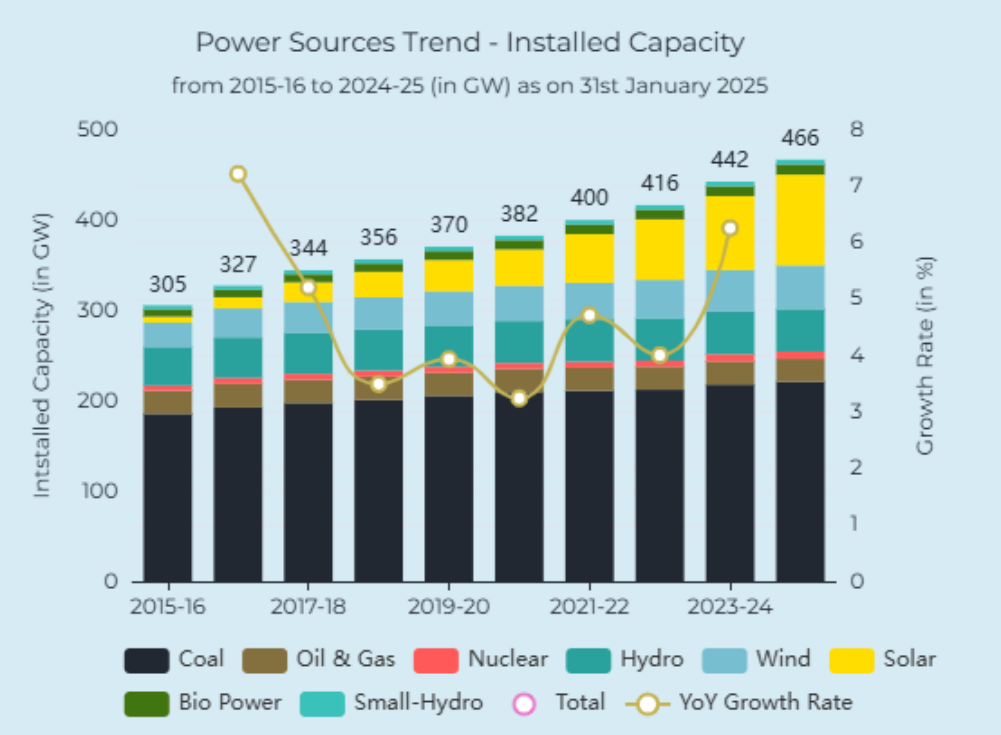
Why in news?

In recent times, Climate change-induced heat stress is one of the key factors driving electricity demand that leads to power shortages in India.

What are the factors driving India's electricity demand?

- India's electricity capacity - India's total installed electricity generation capacity is around 470 GW (gigawatts) with renewable energy accounting for above 40%.





- **Increasing demand** - Since FY21, India's electricity consumption has risen at approximately 9% per annum, compared to an average of 5% annually in the preceding decade.
- The Central Electricity Authority (CEA) had projected electricity demand to grow at a 6% CAGR between 2022 and 2030.

India's Electricity Consumption : Industries - 33%, Households - 28%, Agriculture - 19%

- **Peak demand spikes** – India's electricity peak demand hit *250 GW on May 30, 2024*, exceeding projections by **6.3%**.
- **Economic growth –** India's aspiration to become a $5 Trillion economy by 2030 and $30 Trillion by 2047 requires tripling the current energy production.
- **Urbanization** – India is experiencing rapid urbanization, with its urban population projected to reach 40% by 2030, from 31.16% in 2011.
- **Climate change**–Increasingly hotter summers and colder winters are pushing up electricity demand for cooling and heating requirements.

> *After recording its warmest February in 125 years, India is expected to face **extended heatwaves** in 2025, with electricity demand projected to grow **9-10%**.*

- **Increasing household consumption** – Household electricity demand has grown the fastest over the past decade.
- In summer 2024, air conditioner sales surged by 40-50% year-on-year due *to extreme heat and rising affordability*.

What is the role of renewable energy in meeting the demand?

- **Addressing power shortages** – Achieving 600 GW of renewable energy (RE) by 2030 will prevent supply gaps, especially in northern states facing network constraints.

  A new study by the Council on Energy, Environment and Water (CEEW) found that failure to achieve 500 GW of clean energy capacity by 2030 will lead to power shortages and higher power costs, even if demand grows moderately.

- **Lower power costs** – RE expansion could save ***Rs 42,400*** in procurement costs in 2030 alone.
- **Overcoming network constraints** – Distributed renewable energy(RE) capacity across states reduces grid stress and improves transmission efficiency.
- **Reducing downtime** – Unlike coal plants, which face maintenance-related downtimes, RE with battery storage ensures stable power supply.
- **Lower emissions** – Scaling up RE could cut air pollutant emissions by 23% in 2030, improving environmental quality.
- **Faster deployment** – RE projects, being modular, can be set up much faster than coal plants, which take over seven years to become operational.
- **Decarbonizing the grid** – A 53% clean grid, with 39% variable renewable energy (vRE), aligns with India's Renewable Purchase Obligations (RPOs).
- **Social benefits** – A 600 GW RE target could create 1,00,000 new jobs (2025-30) and improve public health by reducing air pollution.
- **Improved air quality** – 50% renewable energy mix , helps avoiding 160 million tonnes of CO_2 emissions in 2030 and reducing coal consumption by 13%.
- It will significantly decrease air pollutants (PM2.5, PM10, SO_2, NOx), improving health and air quality.

What are the challenges in renewable energy deployment?

Transmission/ Grid connectivity	• Delays in the availability of transmission equipment. • Complexities of grid balancing • Slow infrastructure augmentation
Land issues	• Delays in securing suitable and conflict-free land • Site accessibility problems • Complexities in land aggregation • Rising land prices
Tariff viability	• Contract signing delays • Uncertainty over inter-State transmission system (ISTS) charges ISTS waivers • Shrinking profit margins due to commissioning delays
Supply chain constraints	• Limited availability of specialized materials like photovoltaic cells • Inadequate investment in standardized product designs • Low domestic manufacturing capacity and import dependence

Policy Challenges	• Uncertainty around incentives for inter-State RE plants.

How can India add renewables faster?

India needs to reach 600 GW of clean energy by 2030 to meet rising demand, requiring an annual addition of 70 GW of renewable energy until then.

- **Regional distribution of RE projects** - Currently, five Indian States house three-fourths of the total RE capacity due to ISTS waiver and reverse bids.
- Encouraging distributed RE plants under the PM-KUSUM (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan) and PM Surya Ghar Scheme.
- **Co-locating Solar, Wind and Energy storage** – This would help effectively utilise land and transmission networks and support grid integration of renewables.
- CEEW's study estimates that India will need 280 GWh of battery energy storage systems (BESS) and 100 GWh of pumped hydro storage to integrate 600 GW of RE by 2030.
- **Innovation in bidding and contract designs** – The Union government shall work with States to generate demand for RE procurement, devise suitable tender designs, and proactively resolve bottlenecks.
- It will pave ways for faster RE procurement and RE availability in power exchanges.
- **State-specific clean energy strategies** – States shall be given the flexibility to choose the clean energy technologies that best suit their needs.

Reference

1. The Hindu | Renewable Energy in Meeting Electricity Demand
2. CEEW Report | How Can India Meet its Rising Power Demand