

# STATUS OF ELECTRICAL TRANSMISSION SECTOR IN INDIA

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India's electrical power transmission sector has undergone significant transformation over the past few decades, evolving from a fragmented regional system into one of the largest synchronized grids in the world. Today, the country operates a unified national grid managed largely by Power Grid Corporation of India Limited, which plays a central role in interstate transmission.

One of the major achievements in India's transmission system is the integration of all regional grids into a single frequency grid, completed in 2013. This has improved reliability, enabled efficient power transfer across regions, and reduced the risk of large-scale blackouts. The adoption of advanced technologies such as High Voltage Direct Current (HVDC) systems and 765 kV AC transmission lines has further strengthened long-distance bulk power transfer.

The expansion of renewable energy has significantly influenced transmission development. India's ambitious renewable targets, led by initiatives from the Ministry of Power and Ministry of New and Renewable Energy, require robust transmission infrastructure to connect solar and wind-rich regions (like Rajasthan, Gujarat, and Tamil Nadu) to demand centers. Projects such as the Green Energy Corridors have been launched to address this need.

## Power Transmission Map of India

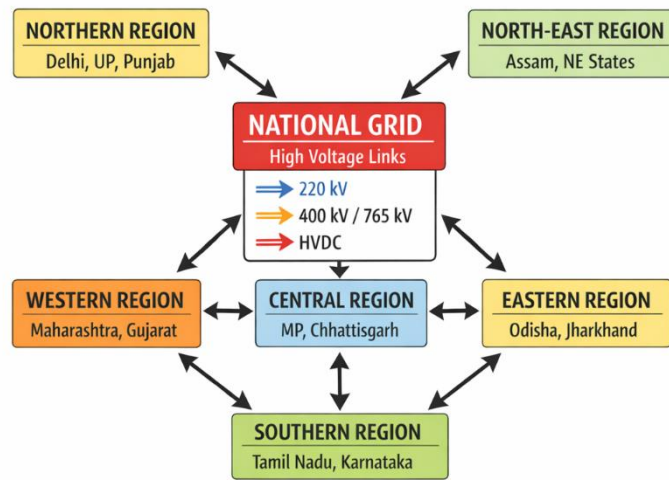
It shows shows

- **High-voltage transmission lines** (220 kV, 400 kV, 765 kV, HVDC)
- **Substations and grid nodes** connecting regions
- **Inter-regional links** forming the **National Grid of India**
- Flow of electricity from **generation hubs** to **load centers**

## Key features of India's power grid

- India operates a **single synchronized national grid**, one of the largest in the world
- Transmission network exceeds **4.6 lakh circuit km** and continues to expand
- Major regions: **Northern, Western, Southern, Eastern, and North-Eastern grids** (now fully interconnected)
- Uses advanced technologies like:
  - **HVDC links** (long-distance bulk transfer)
  - **765 kV AC lines** (ultra-high voltage transmission)

## Simplified Power Grid of India



Power Grid Corporation of India Ltd.

Major Regions Connected

### Simple interpretation

- Dense lines = **high power demand or generation areas** (e.g., Maharashtra, Gujarat, Delhi region)
- Long corridors = **bulk power transfer routes** (e.g., from coal/renewable regions to cities)
- Northeast and Himalayan regions show **hydropower connectivity**

Despite progress, challenges remain. Transmission losses, though reduced over time, are still a concern compared to global standards. Land acquisition issues, environmental clearances, and delays in project execution can slow infrastructure development. Additionally, integrating variable renewable energy into the grid requires better forecasting, storage solutions, and grid flexibility.

In conclusion, India's power transmission sector has made remarkable strides in capacity, technology, and grid integration. However, continued investment, policy support, and technological innovation are essential to ensure a resilient, efficient, and sustainable transmission network that can meet the country's growing energy demands.