

# Coal Plant Inflexibility: How Coal Plant Inflexibility Challenges India's Clean Energy Push

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## Coal Plant Inflexibility Latest News

- India's rapid expansion of renewable energy, with **262 GW** installed capacity and over **51% of total power capacity**, is creating challenges for grid integration due to the operational inflexibility of coal-fired power plants.
- To address this, the Central Electricity Authority has proposed incentives for thermal plants to operate more flexibly, but industry experts warn that running plants at lower loads can damage equipment, increase maintenance costs, and reduce plant lifespan, particularly in older units.

## Coal Plant Inflexibility and Renewable Energy Curtailment

- Coal-fired power plants are expected to reduce output during peak solar generation hours and increase production after sunset when renewable energy supply falls.
- However, many coal plants in India lack this operational flexibility.

- **Rising Curtailment of Renewable Energy** – Due to the inflexibility of coal plants, renewable energy generation—especially solar—is increasingly curtailed during peak production periods, limiting the effective use of green power.
- **Scale of Solar Power Losses** – According to a report, India **lost** 2.3 terawatt-hours (TWh) of solar power between May and December 2025 due to curtailment—enough electricity to power about 14 lakh households for a year.
- **Financial Impact of Curtailment** – Renewable energy curtailment resulted in compensation payments of ₹5.75–6.9 billion to renewable energy generators, as they are compensated when generation is curtailed during grid management or emergency conditions.
- **Minimum Technical Load Constraints** – A key reason for curtailment is that many coal plants cannot operate below **55% Minimum Technical Load (MTL)**, the lowest stable generation level at which a thermal plant can function safely without shutting down.
- **Industry Reluctance to Lower Output** – Thermal power operators are often reluctant to reduce MTL from 55% to 40% because lower loads can affect plant efficiency and increase operational risks.

## Grid Safety Challenges from Renewable Energy Surplus

- India's unified national power grid connects generators, distribution utilities, and major consumers. Maintaining system frequency within the **49.900–50.050 Hz** band is essential for safe and stable grid operation.
- A report by the Central Electricity Authority (CEA) noted that in May 2025, system frequency exceeded the permissible band for nearly 20% of the time, with sustained high-frequency conditions during peak solar generation hours.
  - On May 25, 2025, even after reducing thermal generation to about 58% of capacity and curtailing nearly 10 GW of solar power, the system frequency still rose to 50.48 Hz, raising serious grid safety concerns.
- The inability of many thermal plants to operate below 55% Minimum Technical Load (MTL) limited their ability to reduce output, forcing authorities to curtail renewable energy generation to maintain grid stability.
- Most renewable energy curtailment occurred during high solar generation periods, particularly because several intra-state thermal plants lacked operational flexibility to adjust output efficiently.

## Industry Concerns Over Flexible Operation of Coal Plants

- Despite the CEA's push for flexible operations, power producers remain cautious about running coal plants at lower loads due to potential technical and operational risks.
- Industry experts warn that operating plants below 55% load can cause thermal and mechanical stress on equipment such as turbines and boilers, increasing wear and reducing the overall lifespan of power units.

## Concerns Raised by NTPC

- India's largest power producer, NTPC, has also expressed reservations about two-shift operations and reducing load to 40%, citing negative impacts on the health and reliability of generating units.

- NTPC highlighted that operating below 55% load may be technically difficult, especially because of poor coal quality and operational constraints, which can affect plant efficiency and stability.
- Repeated ramping up and down of generation increases equipment wear and accelerates the degradation of thermal units, making many power producers reluctant to adopt flexible operating practices.

## **Economic and Environmental Costs of Coal Plant Inflexibility**

- The operational inflexibility of coal plants complicates India's ambition of achieving 500 GW of non-fossil fuel capacity by 2030, as renewable energy cannot always be fully integrated into the grid.
- Under the Tertiary Reserve Ancillary Services (TRAS) mechanism, renewable energy producers are compensated when their generation is curtailed during grid emergencies.
- The compensation paid to renewable energy generators is distributed across the power system and reflected in electricity tariffs, meaning consumers indirectly pay for electricity that was generated but not used.
- Curtailing renewable energy prevents the grid from using clean power that could replace fossil-fuel generation, leading to missed opportunities for reducing carbon emissions and improving economic efficiency.

**Source: IE**

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