

The Case for Energy Efficiency

Mains: GS III - Infrastructure - Energy

Why in News?

Recently, India has doubled down on clean energy, yet the power you plug into today is dirtier than it was five years ago and this is a paradox that is at the heart of our energy transition.

What is the status of energy efficiency in India?

- **Energy efficiency** - It is using less energy to perform the same task, which reduces energy waste and lowers costs without sacrificing performance or comfort.
- It is achieved through technological innovations, improved systems, and changes in habits to reduce energy consumption and its associated environmental impact.
 - **For example**, using an LED lightbulb is more energy-efficient than an incandescent one because it produces the same amount of light while using significantly less electricity
- **India's energy mix** - As of June 2025, non-fossil fuel sources account for about 50% of India's total installed capacity.
- **India's grid emission factor (GEF)** - It has increased from 0.703 tCO₂/MWh in 2020-21 to 0.727 tCO₂/MWh in 2023-24, according to the Central Electricity Authority.

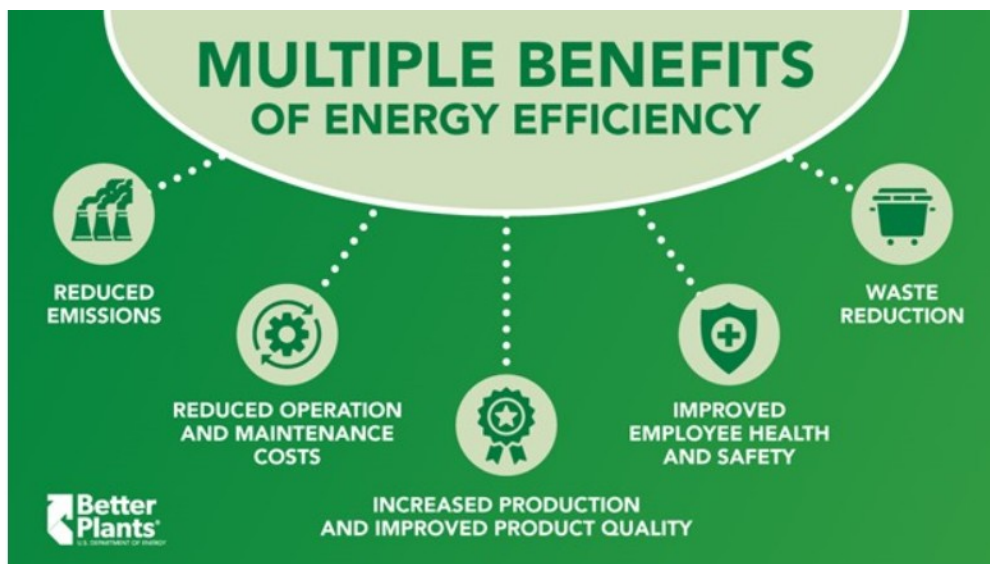
Grid emission factor is a measure of the carbon intensity of electricity.

- **The Capacity-Generation Mismatch** - While renewables now account for a large share of installed capacity, they deliver far less electricity over the year compared to coal or nuclear.
- Solar and wind plants typically run at 15-25% capacity utilisation, versus 65-90% for coal and nuclear.
- In 2023-24, renewables (including hydro) supplied just 22% of total electricity; the rest was fossil fuel-powered.
- **Heavy dependence on coal** - The gap between headline capacity and actual delivered energy is widening, and India's fast-growing demand is being met by the most carbon-intensive source in the system that is coal.
- India's electricity demand also peaks when renewables are least available.
- **Issues with solar** - Solar floods the grid in the afternoon but fades by evening, just as peak loads from households surge.

- Fossil fuel plants, therefore, act as the system's shock absorbers — dispatched to meet night-time and peak demand — but they also lock in emissions.
- This temporal mismatch highlights the limits of capacity expansion alone.

What are the roles of energy efficiency?

- **Energy efficiency** - It is often called the "*first fuel*", it reduces demand before supply even needs to be generated.
- By lowering the evening and night-time peaks, efficiency reduces reliance on coal when emissions are highest.
- **Scaling up efficient appliances** — Fans, air conditioners, and motors — and embedding efficiency in buildings and industrial processes can reshape this curve.
- The benefits extend beyond reduced coal consumption and enhanced opportunity for integrating renewables.
- **Meets demand surge** - Energy efficiency enhances flexibility by flattening demand peaks and allowing demand to align with renewable availability.
- It also prevents lock-in by replacing old, inefficient technologies early.



- **Evidence from India** - Concrete evidence from the Bureau of Energy Efficiency shows that India saved about 200 Million Tonnes of Oil Equivalent of final energy.
- It is equivalent to around 1.29 GT of CO₂eq, and close to ₹760,000 crore in savings, from FY2017-18 to FY2022-23.
- **International examples** - Countries such as France, Norway, and Sweden boast grid emission factors of just 0.1-0.2 tCO₂/MWh, largely thanks to large shares of hydro and nuclear electricity.
- India, at 0.727, starts from a coal-heavy base and faces relentless demand growth. This makes efficiency part of the core strategy, not just an option. Without it, renewables risk being stranded in the wrong hours.

What India needs to do?

- **Connection of batteries** - India, it must enable homes and offices to connect their batteries into virtual power plants, helping the grid glide over the peak demand.
- **Accelerate appliance efficiency standards** - It must move markets towards 4- and

5-star products and steadily raise benchmarks.

- **Support SMEs** - It must support small and medium enterprises (SMEs) to adopt efficient motors, pumps, and processes.
- **Flexible pricing** - It must enable flexible pricing by adopting tariff structures that reward consumers for shifting demand to periods of high renewable availability.
- **Incentives for scrappage** - It must introduce scrappage incentives for old, energy-guzzling equipment.
- **Enable DISCOMS potential** - It must enable electricity distribution companies to procure “electricity services”, such as green cooling, which allows for high-efficiency air conditioning powered by RTC clean power.

What lies ahead?

- The Central Electricity Authority’s National Electricity Plan projects a fall in India’s GEF to 0.548 by 2026-27, and 0.430 by 2031-32.
- Achieving this requires more than just building solar and wind farms.
- It demands a flexible system approach - with efficiency at the centre.
- India has grown its economy while cutting emissions intensity by 33% between 2005 and 2019, as noted in its Fourth Biennial Update Report to the UNFCCC.
- But the rising GEF calls for a balanced approach: accelerate supply-side investments in renewables, storage, and transmission, while embedding efficiency across households, industries, and cities.
- If India wants to actually decarbonise its grid, efficiency must become the first fuel — and flexibility, not fossil fuels, must power the future.
- To truly decarbonise, India needs flexibility along with more gigawatts. While Round-the-Clock (RTC) renewable electricity, at less than ₹5 per kWh, costs less than new coal-based power stations, upscaling is slow.
- We need policies that enable more land, transmission lines, and investment.

Reference

[The Hindu| Energy Efficiency](#)