

# Energy Equity and Ecology

Posted at: 16/07/2025

## Energy Equity and Ecology: India's Green Power Shift

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### Context:

India has **achieved 50% of its installed electricity capacity from non-fossil fuel sources**, five years ahead of the **2030 target** set under its **Nationally Determined Contributions (NDCs)** to the **Paris Agreement**. This marks a significant step toward low-carbon development while maintaining energy security.

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### What is the 50% Non-Fossil Fuel Capacity Milestone?

- As of **June 30, 2025**, India's total installed electricity generation capacity stands at **484.82 GW**.
  - Out of this, **non-fossil fuel sources contribute 50.08%**, crossing the halfway mark.
  - **Break-up of Installed Capacity:**
    - **Thermal (fossil-based):** 241.04 GW (**49.92%**)
    - **Renewable Energy (RE):** 184.62 GW
      - **Large Hydro:** 49.38 GW
      - **Nuclear:** 8.78 GW
    - **Total Non-Fossil Fuel Capacity:** 242.78 GW (**50.08%**)
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## Key Factors Behind This Achievement:

- **Strong Political Will:**

- Consistent policy direction and funding from the **central government**, especially under **PM Modi** and the **Ministry of New and Renewable Energy (MNRE)**.

- **Private Sector Participation:**

- Increased **investments from Indian and foreign companies** in solar, wind, and hybrid technologies.

- **Progressive State Initiatives:**

- States like **Gujarat** and **Tamil Nadu** took the lead with **renewable energy parks** and **wind corridors**.

- **Digital Infrastructure:**

- Implementation of **smart meters**, **EV charging stations**, and **digital grid balancing tools** for better renewable integration.

- **International Cooperation:**

- Collaborations under frameworks like the **International Solar Alliance (ISA)** and **Just Energy Transition Partnership (JETP)** enabled **technology transfer** and **concessional financing**.

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## Challenges and Concerns:

- **Grid Instability:**

- Renewable energy's variable nature makes **grid frequency balancing** more difficult.

- **Land Conflicts:**

- Solar and wind projects sometimes **displace farmlands**, forests, or community spaces, leading to **environmental and social disputes**.

- **Storage Deficiencies:**

- Limited availability of **large-scale battery storage** or **pumped hydro** affects 24/7 renewable supply.

- **Intermittency Issues:**

- Solar and wind generation depends on **weather and time**, making supply less predictable.

- **Cybersecurity Threats:**

- As power systems digitalise, they face risks of **hacking, malware, and cyber disruptions**.

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## Way Forward:

- **Grid Modernisation:**

- Upgrade to **AI-driven, smart grids** with **two-way communication** and accurate demand forecasting.

- **Expand Storage Solutions:**

- Invest in **Battery Energy Storage Systems (BESS)** and **pumped hydro** to stabilize renewable energy flows.

- **Promote Circular Economy:**

- Create systems to **recycle solar panels, batteries, and wind turbines**, reducing environmental waste.

- **Ensure Energy Equity:**

- Encourage **rooftop solar** and **microgrids** in **rural, tribal, and underserved areas** for inclusive access.

- **Scale Up Green Hydrogen:**

- Develop **green hydrogen** as a **clean fuel** for transport, steel, cement, and oil refineries.

- **Strengthen Cyber Resilience:**

- Enhance **digital security** through **firewalls, real-time monitoring**, and national cybersecurity frameworks.

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## Conclusion:

India reaching **50% non-fossil fuel installed capacity** ahead of schedule reflects the **compatibility of climate action with economic growth**. It bolsters India's image as a **global clean energy leader**. Moving forward, the emphasis must be on building a **resilient, inclusive, and intelligent energy ecosystem** that supports long-term **sustainability** and **energy justice**.



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