Energy Equity and Ecology

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Energy Equity and Ecology: India’s Green Power Shift

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.

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%)**

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**.

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**.

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.

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**.