Wind Energy in India: Progress, Policies and Potential

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Why in news?

The National Institute of Wind Energy (NIWE) says that India has wind power potential for 1,163.86 GW at 150 metres above ground level, and is ranked fourth in the world for installed wind energy capacity.

Among the wind energy generating States, the repowering potential is the highest in Tamil Nadu with over 7,000 MW of installed capacity that can be replaced or refurbished.

Tamil Nadu's Wind Power Capacity:

- Tamil Nadu is a leader in wind energy generation in India, with an **installed capacity of 10,603.5 MW** as of the latest data from the **Ministry of New and Renewable Energy (MNRE)**. The state has been installing wind turbines since the **1980s** and has become the second-largest state in India in terms of wind energy capacity.
- The state contributes **nearly 15% of the national wind energy capacity**, with **68.75 GW** of potential at 120 meters above the ground level.

National Wind Energy Capacity:

- According to the **National Institute of Wind Energy (NIWE)**, India’s total wind energy potential at 120 meters above the ground is **695.51 GW**.
- India is ranked **4th globally** in terms of installed wind energy capacity, but only about **6.5%** of this potential is currently harnessed.

What is Repowering and Refurbishing of Wind Turbines?

Repowering refers to the process of replacing old, inefficient, or underperforming wind turbines with new, more powerful ones. This is typically done for turbines older than **15 years** or with a capacity of **less than 2 MW**.

Refurbishing involves upgrading existing turbines to increase their efficiency or capacity without completely replacing them. This can include:

- **Increasing the height** of the turbine.
- Replacing blades to improve performance.
- Upgrading the gearbox or other components to enhance the turbine’s energy generation capacity.

Life Extension is another process where safety measures are implemented to extend the operational life of older turbines.

Why Are Wind Energy Generators Opposing the New Policy?

The Tamil Nadu government introduced the **"Tamil Nadu Repowering, Refurbishment and Life Extension Policy for Wind Power Projects - 2024"** in August 2024. However, **wind energy generators** have expressed opposition to this policy for several reasons:

1. **Financial Viability**:

- **Repowering** involves replacing old turbines with larger, more efficient ones, which require more **land** and **infrastructure** (like substations and transmission systems). In some areas, such as **Aralvaimozhi**, potential wind sites have not been fully utilized due to delays in building necessary infrastructure.
- The policy does not provide sufficient incentives or financial benefits for wind generators to invest in these upgrades, as they argue that **repowering** can be a **financially unviable** option.

1. **Impact on Energy Banking**:

- **Wind turbines installed after 2018** in Tamil Nadu do not have the **energy banking facility**—meaning that when energy is generated and not immediately used, it cannot be stored or carried over to later.
- If older turbines are **repowered**, they are treated as **new installations**, and the **banking facility** issue persists, making the process less commercially attractive to generators.

1. **Land and Space Constraints**:

- Repowering with larger turbines requires **more land**. For example, a **2.5 MW turbine** requires about **five acres**, compared to **three acres** for a 2 MW turbine. This can be a significant issue in areas where land is limited, particularly where **old, small turbines** are concentrated.

1. **Lack of Focus on Ground-Level Challenges**:

- Generators argue that the **policy** doesn't fully address the practical issues they face in the field. Issues like **wind energy evacuation infrastructure**, the need for **upgraded transmission systems**, and gaps in **government support** are seen as hurdles that need more attention in the policy to make repowering and refurbishing more successful.

Repowering Potential and Way Forward

- **Tamil Nadu's Repowering Potential** is considered the highest in India, with **over 7,000 MW** of installed capacity that could be repowered or refurbished. This could significantly **boost energy production**, particularly during the **windy peak seasons**, by up to **25%**.
- However, wind energy generators stress that the current **policy does not promote wind energy generation** enough, and they argue that it needs to address the **economic viability** of repowering projects. Without adequate **financial incentives**, the sector may struggle to achieve the full potential of wind energy.

Overview of Wind Energy in India

Wind energy is a key component of India's renewable energy strategy. With the country's vast and varied landscape, India has significant potential for wind power generation, especially in states with favorable wind conditions. The sector has made notable progress in recent years, and the government has introduced a series of initiatives and policies to boost its growth.

Wind Energy Potential in India

1. **Wind Resource Assessment**:

- Wind energy generation is **intermittent** and highly location-dependent, making **wind resource assessment** essential for identifying optimal sites. The government, through the **National Institute of Wind Energy (NIWE)**, has established over **900 wind-monitoring stations** across the country to assess wind speeds and identify potential sites.

1. **Wind Potential Mapping**:

- Wind potential in India has been mapped at different heights, with the following figures:
- **695.50 GW at 120 meters** above ground level.
- **1163.9 GW at 150 meters** above ground level.
- This highlights India's substantial wind power potential, though actual generation remains far below this theoretical capacity.

1. **Leading Wind Energy States**:

- **Eight states** dominate India's wind energy potential, contributing to about **93%** of the country's installed capacity. These states include:
- **Andhra Pradesh**
- **Gujarat**
- **Karnataka**
- **Madhya Pradesh**
- **Maharashtra**
- **Rajasthan**
- **Tamil Nadu**
- **Telangana**

Current Capacity and Growth

1. **Installed Capacity**:

- As of **August 2023**, India’s total **installed wind power capacity** stands at **44 GW**, making India the **fourth-largest** country in the world in terms of installed wind power capacity.
- India has set an ambitious target to achieve **140 GW** of wind power capacity by **2030**, a substantial increase that will require significant investments in infrastructure and technology.

1. **Manufacturing Base**:

- India has developed a strong **domestic manufacturing base**, with an annual capacity of **about 15,000 MW** for producing wind turbines and related components. This positions India as a leader in the wind energy manufacturing sector, further aiding the growth of its wind energy capabilities.

1. **Major Wind Parks**:

- India has developed some of the largest **wind parks** in the world. Notable examples include:
- **Jaisalmer Wind Park** (1,064 MW) in Rajasthan.
- **Muppandal Wind Farm** (1,500 MW) in Tamil Nadu.

Government Incentives and Support for Wind Energy

1. **Incentives for Investment**: The Indian government has rolled out several incentives to encourage both public and private sector investment in wind energy projects, including:

- **Accelerated Depreciation** for wind projects, allowing investors to recover costs faster.
- **Customs duty exemptions** on select wind turbine components.

- **Income tax exemptions** for wind power projects for up to 10 years.
- **100% excise duty exemption** on select wind turbine parts.
- **Renewable Energy Certificates (REC)** mechanism to encourage the generation of renewable energy.

1. **Foreign Direct Investment (FDI)**:

- The Indian government allows **100% FDI** in wind energy projects through the **automatic route**, which has facilitated greater foreign investment in the sector.

1. **Green Energy Corridor**:

- The government is implementing a **Green Energy Corridor** project to facilitate the integration of renewable energy, including wind, into the national grid. This project is crucial for enhancing grid stability and enabling the efficient transmission of renewable energy from remote wind farms to major consumption centers.

1. **Financing Support**:

- The **Indian Renewable Energy Development Agency (IREDA)** offers **financing schemes** to support wind power projects.
- Special incentives are also provided for **renewable energy technology exports**, bolstering India's position as a key player in the global wind energy market.

Policy Support for Wind Energy Development

1. **Repowering and Hybrid Initiatives**:

- The government has initiated **repowering** schemes to optimize older wind turbines with new, more efficient ones. This helps increase the capacity and efficiency of existing wind farms without the need for large-scale new installations.
- There is also a push to create **wind-solar hybrid systems**, which are expected to add **15,000 MW of hybrid capacity** by 2025, including a **10 GW target** by **2022**.

1. **Wind-Solar Hybrid Capacity**:

- The government envisions adding **20.2 GW of wind power capacity** between **2021-2025**, which includes **hybrid wind-solar capacity**.
- The policy support for **wind-solar hybrid capacity** will help overcome intermittency issues by ensuring that wind and solar energy can complement each other throughout the day and night.

1. **Renewable Purchase Obligation (RPO)**:

- The government has set a **Wind Renewable Purchase Obligation (RPO)** trajectory up to **2030**, encouraging power utilities to purchase a certain percentage of their energy from wind and other renewable sources.
- Other measures include **waiving inter-state transmission system (ISTS) charges** for wind and solar power sales until **June 2025**, which is designed to make renewable energy trade more efficient and cost-effective.

1. **Competitive Bidding and Tariffs**:

- To promote competitive pricing and efficiency in wind power generation, the government has introduced **tariff-based competitive bidding processes** for wind energy projects.
- These bidding mechanisms are designed to drive down the cost of wind power and improve the financial viability of new projects.