



Clean Energy: India's Path to Sustainability

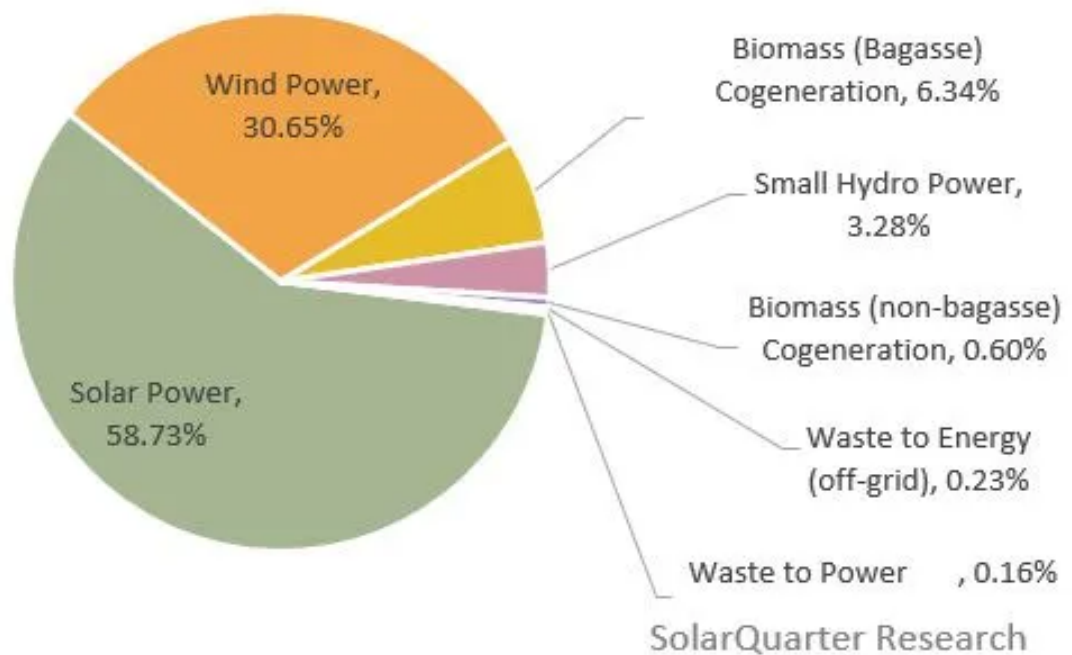
This editorial is based on “[Get the transition right: How govt is pushing for a clean-energy shift](#)” which was published in Business Standard on 03/03/2025. The article brings into picture the critical need for India's clean energy transition, highlighting its role in economic growth and climate resilience.

For Prelims: [India's clean energy transition](#), [Crude oil](#), [Natural gas](#), [International Energy Agency](#), [COP26 pledge](#), [National Green Hydrogen Mission](#), [Global Biofuels Alliance \(GBA\)](#), [International Solar Alliance](#), [Carbon Credit Trading Scheme](#), [PM e-Drive Scheme](#).

For Mains: Significance of Clean Energy Transition, Key Issues Hindering India's Clean Energy Transition.

[India's clean energy transition](#) is both an **economic necessity and an environmental imperative**, ensuring electricity access for millions while mitigating climate risks. However, global pushback against climate action, **compounded by rising costs and insurance challenges**, threatens progress. As climate impacts intensify, **prioritizing solutions that balance sustainability with livelihood security is crucial**. The challenge lies in accelerating this transition while addressing economic vulnerabilities.

India Renewable Energy Mix (September 2024)



Why Clean Energy Transition is Crucial for India?

- **Energy Security and Reduced Import Dependence:** India imports nearly 85% of its [crude oil](#) and 50% of its [natural gas](#), making it highly vulnerable to global price shocks and supply disruptions.
 - Expanding domestic renewable energy can enhance energy independence and reduce the burden of a high import bill.
 - The [International Energy Agency \(IEA\)](#) reported **India was the world's second-largest crude oil net importer in 2023**, while the Russia-Ukraine war exposed risks of fossil fuel dependence.
 - Increasing renewable capacity to **500 GW by 2030**, as per India's [COP26 pledge](#), can mitigate these vulnerabilities.
- **Economic Growth and Job Creation:** A transition to clean energy can drive industrial **expansion, innovation, and employment**, particularly in solar, wind, and green hydrogen sectors.
 - The **Council on Energy, Environment, and Water (CEEW)** estimates that India's renewable sector could create **one million people by 2030**.
 - This shift will **open new opportunities in manufacturing and grid infrastructure**, reducing economic disparities.
- **Climate Resilience and Pollution Control:** India is one of the **most [climate-vulnerable nations](#)**, facing frequent **heat waves, floods, and rising sea levels**.
 - A clean energy transition can significantly **cut [carbon emissions](#) and reduce air pollution**, which is responsible for millions of deaths annually.
 - Air pollution has caused 8.1 million deaths around the world in 2021 with China and India accounting for more than half of the global burden.
 - For instance, **Delhi in 2024 recorded a three-year high in terms of annual PM2.5** (particulate matter having a diameter of 2.5 microns or less) concentration, highlighting the urgent need for clean energy adoption.
- **Rural Electrification and Energy Access:** Renewable energy, especially **decentralized solar and wind solutions**, can provide reliable power to remote areas, reducing energy poverty.

- This will boost education, healthcare, and economic activities in underserved regions.
- In 2024, India added **24.5 GW of solar installations**, an over two-fold increase compared to 2023. Utility-scale installations reached **18.5 GW capacity**, up 2.8 times from 2023.
- **Investment and Global Leadership in Green Energy:** India has positioned itself as a leader in renewable energy, attracting global investments and strengthening diplomatic ties through clean energy initiatives.
 - Expanding the sector can boost **foreign direct investment (FDI)** and technological collaborations.
 - Investment in renewable energy in India reached a record **US\$14.5 billion** in the financial year-2021-22. While initiatives like the [Global Biofuels Alliance \(GBA\)](#) and the [International Solar Alliance \(ISA\)](#) showcase India's leadership in global climate diplomacy.
- **Green Hydrogen and Industrial Decarbonization:** India's heavy industries, such as **steel and cement**, rely on **coal-based energy**, but green hydrogen offers a sustainable alternative.
 - Scaling up hydrogen production can help India become a global exporter while reducing industrial emissions.
 - The [National Green Hydrogen Mission](#), launched in 2023 with an outlay of ₹19,744 crore, **aims to produce 5 MMT of green hydrogen annually by 2030.**
- **Sustainable Urbanization and EV Transition:** India's rapid urbanization demands a **clean energy-driven transport and infrastructure ecosystem.**
 - Expanding electric vehicles (EVs) and smart grids can make cities more sustainable while cutting oil dependency.
 - The [PM e-Drive Scheme](#) has a **₹10,900 crore** outlay for two years (April 2024 – March 2026) to boost EV adoption.
- **International Climate Commitments and Carbon Markets:** India has committed to achieving **net-zero emissions by 2070**, requiring a major clean energy shift.
 - Participation in **carbon trading and emissions reduction schemes** can provide financial incentives and global credibility.
 - The [Carbon Credit Trading Scheme \(2023\)](#) launched under the **Energy Conservation (Amendment) Act, 2022**, allows industries to trade carbon credits, while India's updated **Nationally Determined Contributions (NDCs)** target a 45% emissions reduction by 2030

What are the Key Issues Hindering India's Clean Energy Transition?

- **Inadequate Grid Infrastructure and Storage Limitations:** India's **electricity grid is currently not equipped to handle the variability of renewable energy**, leading to frequent curtailments and inefficiencies.
 - The lack of **large-scale energy storage solutions** makes integrating solar and wind power challenging, especially during peak demand.
 - The National Electricity Plan-II of the Central Electricity Authority (CEA) estimates that **India will require over lakh crore investment in transmission infrastructure to meet its power demand by 2032.**
- **Fossil Fuel Lobby and Policy Inconsistencies:** India's energy mix is currently dominated by coal for about **70% of its power generation.**
 - And in turn, **Coal and oil industries continue to receive significant subsidies** and policy backing, slowing the transition to cleaner alternatives.
 - In FY 2023, both clean energy and fossil fuel subsidies grew by around 40%. The **Ministry of Coal** has set a goal to produce **1.3 billion tonnes** of domestic coal by **FY 2027.**
 - Millions of workers depend on coal mining and fossil fuel-based industries, and a rapid shift to clean energy could lead to job losses and economic distress in these regions.
 - A just transition plan is needed to reskill workers and develop alternative industries.



- **Financial Stress on DISCOMs (Distribution Companies):** India's power distribution companies (DISCOMs) are deeply in **debt**, limiting their ability to invest in clean energy infrastructure.
 - **High transmission losses, poor tariff collection, and subsidies** for fossil fuel-based power add to their financial distress.
 - RBI's report highlights that state DISCOMs remain a burden on finances, with accumulated losses reaching **₹6.5 lakh crore (2.4% of GDP) by 2022-23**.
- **Slow Progress in Domestic Manufacturing and Supply Chain Gaps:** India remains dependent on imports for **solar modules, wind turbines, and lithium-ion batteries**, making clean energy transition vulnerable to global supply chain disruptions.
 - Domestic production is still in its infancy despite government incentives.
 - For instance, in 2023-24, India imported **\$7 billion worth of solar equipment**, with China supplying **62.6%**
 - The **PLI scheme for solar PV manufacturing** has a budget of **₹24,000 crore** but will take time to scale up production.
- **Land Acquisition and Environmental Clearances:** Large-scale renewable energy projects require **vast land areas**, often leading to conflicts with farmers, displacement, and environmental concerns.
 - For instance, **Rewari villagers in Rajasthan's Jaisalmer** have been protesting against the state government's move to transfer land to the Adani Group for setting up a **450 MW solar power plant**.
 - Delays in land approvals and concerns over biodiversity impact slow down project implementation.
 - For instance, the **Great Indian Bustard conservation case** led to Supreme Court restrictions on overhead power lines. (though recently reversed its blanket ban on overhead power transmission cables)
- **Intermittency and Reliability of Renewable Energy:** Unlike coal and gas-based power, renewables like solar and wind are **variable** and **cannot provide round-the-clock electricity without costly storage solutions**.
 - This raises concerns about grid stability and meeting peak-hour demand. In **June 2024**, power demand in India peaked at 243.3 GW, but solar and wind contribution was not up to the mark, **forcing the government to extend coal plant operations** despite its clean energy targets.
- **Slow Adoption of Electric Vehicles (EVs) and Charging Infrastructure:** The EV transition is essential for reducing oil dependence, but challenges like **inadequate charging stations, high battery costs**, and slow consumer adoption hinder progress.
 - A weak charging network **outside metro cities** limits expansion. As of February 2024, India has **only 12,146 public EV charging stations** against the requirement of a total of **3.9 million public and semi-public charging stations**, maintaining a ratio of **1 station for every 20 vehicles**.

What Measures can India Adopt to Accelerate India's Clean Energy Transition?

- **Strengthening Grid Infrastructure and Energy Storage:** India must modernize its power grid to integrate variable renewable energy sources seamlessly while investing in large-scale battery storage.
 - Developing **smart grids, pumped hydro storage, and hybrid renewable power** projects can enhance grid reliability.
 - **Decentralized renewable energy solutions**, including rooftop solar and microgrids, should be promoted to reduce transmission losses.
 - The synergy between the **Green Energy Corridor** and the **Revamped Distribution Sector Scheme (RDSS)** can ensure efficient power evacuation and distribution.

- **Financial Reforms for DISCOMs and Renewable Investments:** Revitalizing power distribution companies (DISCOMs) by improving **revenue collection, reducing losses**, and ensuring timely payments to renewable energy producers is essential.
 - Innovative financing mechanisms like green bonds, viability gap funding, and concessional loans can attract private investment.
 - Expanding **risk-sharing mechanisms** for renewable projects will build investor confidence.
- **Boosting Domestic Manufacturing and Supply Chain Resilience:** Reducing dependence on **imported solar modules, wind turbines, and lithium-ion batteries** by strengthening domestic production is critical.
 - Expanding the **Production-Linked Incentive (PLI) scheme** for solar PV and battery storage will encourage local manufacturing.
 - Creating **special renewable energy zones** with tax incentives can attract global investors.
 - Promoting **research and development (R&D) in alternative battery chemistries like sodium-ion and solid-state batteries** will enhance energy security.
- **Accelerating Land Acquisition and Environmental Approvals:** Streamlining land acquisition for renewable energy projects while **ensuring minimal ecological impact can fast-track implementation**.
 - Digitizing land records, adopting a single-window clearance system, and integrating local communities in decision-making can reduce conflicts.
 - Renewable energy parks should be **set up on degraded land and wastelands** to avoid competition with agriculture.
 - Expediting approvals under the [Environmental Impact Assessment \(EIA\) framework](#) will enhance investor confidence.
- **Expanding Electric Vehicle (EV) Ecosystem and Green Mobility:** Developing an extensive EV charging network, incentivizing battery swapping infrastructure, and promoting indigenous battery manufacturing can accelerate EV adoption.
 - Strengthening **urban public transport through electrification** and integrating EVs with renewable energy will reduce fossil fuel reliance.
 - Encouraging electric freight and long-haul transport will lower emissions in the logistics sector.
 - The convergence of **PM E-Drive** and the **National Electric Mobility Mission Plan (NEMMP)** can create a holistic green mobility ecosystem.
- **Diversifying Energy Mix with Green Hydrogen and Bioenergy:** Scaling up green hydrogen production for **industrial decarbonization** and energy storage can drive long-term sustainability.
 - Developing a **domestic electrolyzer manufacturing ecosystem** and leveraging offshore wind energy for hydrogen production will reduce costs.
 - Promoting **biomass-based power, biofuels, and waste-to-energy solutions** can enhance rural employment and energy security.
 - Linking the **National Green Hydrogen Mission** with the **Global Biofuels Alliance (GBA)** will strengthen India's position in alternative fuels.
- **Strengthening Policy Stability and Regulatory Framework:** Ensuring long-term policy stability, reducing frequent tariff changes, and **creating enforceable renewable purchase obligations (RPOs)** can provide clarity to investors.
 - Implementing a robust carbon pricing mechanism and expanding the **Carbon Credit Trading Scheme** will create market-driven incentives for emissions reduction.
 - Strengthening compliance mechanisms for **Renewable Energy Certificates (REC)** and **Green Open Access policies** will promote private-sector participation.
- **Ensuring a Just Transition for Coal-Dependent Regions:** A **structured transition plan for coal-dependent states** must include reskilling programs, economic diversification, and social security measures.
 - Establishing a **Just Transition Fund** to support alternative livelihoods in coal mining regions can mitigate economic disruptions.
 - Promoting clean energy parks, green industries, and sustainable tourism in affected areas can create employment opportunities.

- The **District Mineral Foundation (DMF) funds** can be repurposed to facilitate community-led clean energy projects.
- **Decentralized Renewable Energy for Rural and Agricultural Growth:** Expanding **off-grid solar, microgrids, and solar pumps** can enhance energy access and agricultural productivity in rural areas.
 - Promoting **agri voltaics (solar farming)** can ensure dual land use without affecting food security.
 - Strengthening financing mechanisms for small-scale renewable projects through microfinance institutions can encourage community participation.
 - Synergizing **PM-KUSUM** with the **Rooftop Solar Programme** will accelerate decentralized solar adoption.
- **Enhancing International Cooperation and Climate Financing:** Leveraging global climate funds, bilateral agreements, and technology transfer mechanisms can boost India's clean energy transition.
 - Strengthening collaboration with **G20 nations, the International Solar Alliance (ISA), and the UNFCCC** can secure concessional financing and advanced technologies.
 - Expanding participation in global carbon markets can create new revenue streams for renewable projects.
 - India must push for greater access to the **Loss and Damage Fund** and the **Global Environment Facility (GEF)** to support climate adaptation and mitigation.

Conclusion:

India's clean energy transition is essential for energy security, economic growth, and environmental sustainability. Addressing challenges like **grid infrastructure, financial constraints, and policy inconsistencies** will accelerate this shift. A balanced approach ensuring both sustainability and livelihood security is crucial for long-term success. This aligns with **SDG 7 (Affordable and Clean Energy)**, **SDG 8 (Decent Work and Economic Growth)**, and **SDG 13 (Climate Action)**.

Drishti Mains Question:

Discuss the significance of clean energy transition for India in the context of energy security, economic growth, and climate resilience. What are the key challenges hindering this transition, and suggest viable policy measures to accelerate it.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q. With reference to the Indian Renewable Energy Development Agency Limited (IREDA), which of the following statements is/are correct? (2015)

1. It is a Public Limited Government Company.
2. It is a Non-Banking Financial Company.

Select the correct answer using the code given below:

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Ans: (c)

Mains:

Q. "Access to affordable, reliable, sustainable and modern energy is the sine qua non to achieve Sustainable Development Goals (SDGs)". Comment on the progress made in India in this regard. **(2018)**

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