



## India's Leap Towards Green Energy

This editorial is based on [“Why the old script can't work for India's green transition”](#) which was published in The Indian Express on 03/06/2024. The article brings into picture the current state of India's Green Energy Transition and calls for reforms in its approach.

**For Prelims:** [Green Energy](#), [Greenhouse gases](#), FDI in Renewable Energy, [Pradhan Mantri Sahaj Bijli Har Ghar Yojana \(SAUBHAGYA\)](#), [Green Energy Corridor \(GEC\)](#), [National Smart Grid Mission \(NSGM\)](#), [Smart Meter National Programme](#), [Faster Adoption and Manufacturing of \(Hybrid &\) Electric Vehicles \(FAME\)](#), [International Solar Alliance \(ISA\)](#), [Surya Ghar Muft Bijli Yojana](#), Dhundi Solar Project in Maharashtra.

**For Mains:** Major Roadblocks in India's Green Energy Transition, Measures to Accelerate Green Energy Transition

India finds itself at a **pivotal juncture in its energy journey**, navigating a significant transition towards a **greener and more sustainable future**. Driven by the dual objectives of reducing its dependence on imported fossil fuels and meeting its commitments to decarbonization and sustainability, the country is accelerating its shift towards [clean renewable energy sources](#).

As India embarks on this crucial transition, it must navigate the complex interplay between its [energy security](#), **economic competitiveness**, and **environmental sustainability goals**. The rising tensions between major powers and the race for technological superiority, particularly in the realms of renewable energy and electric vehicles, have significant ramifications for India's green ambitions, including **supply chain resilience**, **domestic investment climate**, and **national security** considerations.

### What is Green Energy?

- Green energy is defined as energy derived from **renewable sources**. It is also known as clean, sustainable, or renewable energy.
- Green energy generation emits no dangerous [greenhouse gases](#) into the atmosphere, resulting in **little or no environmental impact**.
- [Solar](#), [wind](#), [geothermal](#), [biogas](#), **low-impact hydroelectricity**, and certain qualified biomass sources are all key green energy sources.

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## Types of renewable energy sources



### Hydropower

Gravitational potential energy of water converted into electrical energy through a hydraulic turbine



### Wind energy

Kinetic energy of wind converted into electricity by wind turbines



### Solar energy

The sun's energy turned into electricity heat energy by solar panels/solar heaters



### Biomass

Energy obtained from plant and animal remains; e.g., burning wood produces heat energy



### Geothermal energy

Heat energy trapped underneath the earth's crust converted into electricity by steam turbines



### Ocean energy

Oceanic thermal and tidal energy converted into electricity by turbines and other systems



### Hydrogen

Hydrogen's potential chemical energy converted into electricity by hydrogen fuel cells

## Why is the Green Energy Transition Significant for India?

- **Combating Climate Change and Air Pollution:** India is the third largest emitter of **greenhouse gasses** after China and the US.
  - Also, according to the **2022 State of Global Air Report**, at least 1.6 million deaths were attributable to air pollution alone in India in 2019.
  - Green energy adoption will significantly reduce emissions and improve air quality, leading to a healthier population.
- **Energy Security and Import Dependence:** India is likely to account for **25% of global energy demand growth** over the next two decades exposing the country to price fluctuations and geopolitical tensions.
  - For instance, the ongoing **Russia-Ukraine war** has disrupted global energy markets, leading to a spike in oil prices.
  - Green energy sources offer **greater energy independence and price stability.**
- **Attracting Investments and Global Leadership:** The global focus on sustainability is attracting significant investments in green technologies.
  - By transitioning to green energy, **India can position itself as a leader in the clean energy sector**, attracting investments and fostering technological advancements.

- **Unlocking Opportunities in New Technologies:** The green energy transition opens doors for India to develop and utilize cutting-edge clean energy technologies like **energy storage solutions and smart grids**.
  - This fosters innovation and positions India at the forefront of the **global clean energy revolution**.

## What are the Government's Recent Initiatives Related to Green Energy Transition?

- **FDI in Renewable Energy:** Permitting up to 100% FDI under the automatic route for renewable energy projects.
- [Pradhan Mantri Sahaj Bijli Har Ghar Yojana \(SAUBHAGYA\)](#)
- [Green Energy Corridor \(GEC\)](#)
- [National Smart Grid Mission \(NSGM\) and Smart Meter National Programme](#)
- [Faster Adoption and Manufacturing of \(Hybrid &\) Electric Vehicles \(FAME\)](#)
- [International Solar Alliance \(ISA\)](#)
- [Surya Ghar Muft Bijli Yojana](#)

## What are the Major Roadblocks in India's Green Energy Transition?

- **High Dependence on Fossil Fuels:** India's energy mix is still heavily reliant on fossil fuels, with coal accounting for around **55% of the country's electricity generation**.
  - This entrenched dependence on traditional energy sources poses a significant challenge in transitioning towards renewable energy sources.
- **Siloed Policy and Governance:** The current two-pronged approach, with separate ministries managing **fossil fuels and renewables**, lacks coordination.
  - This fragmented structure hinders integrated planning, resource allocation, and achieving long-term goals.
  - For instance, expansion of coal mining by the **Ministry of Coal** might contradict renewable energy targets set by the **Ministry of New and Renewable Energy**.
- **Vulnerability in Green Technology:** India's dependence on imported green technology, particularly China's dominance in solar panels, wind turbines, and critical minerals, creates a vulnerability.
  - Around **70% of India's solar power generation capacity** is built on China-made solar equipment.
  - This reliance exposes India to potential supply chain disruptions and price hikes if geopolitical tensions rise.
- **Grid Integration Challenges:** The intermittent nature of renewable energy sources like **solar and wind** poses significant challenges in maintaining grid stability and ensuring a reliable and consistent power supply.
- **Limited Energy Storage Capacity:** Energy storage solutions like pumped hydro and battery storage are still in their early stages in India.
  - This **limits the ability to store excess renewable energy** for later use, hindering their effectiveness in meeting peak demand periods.
  - India needs an advanced **battery energy storage system (BESS)** ecosystem to support 500GW of non-fossil energy targets by **2032**.
- **Waste Management of Solar Panels and Wind Turbines:** The increasing use of solar panels and wind turbines raises concerns about their **end-of-life management**.
  - India generated about **100 kilotons (kt) of solar waste** in the financial year (FY) 2022-2023 and it is expected to reach 600 kt by 2030.
- **Water-energy Nexus Challenges:** The water-intensive nature of certain renewable energy technologies, such as **concentrated solar power (CSP)**, poses challenges in water-stressed regions of India.
  - The water level in the **country's 150 main reservoirs** has already dropped to **23%** as per **Central Water Board**, significantly posing a challenge to the adoption of water intensive renewable energy technologies.

## How India can Accelerate Green Energy Transition?

- **Green Social Entrepreneurship and Grassroots Innovation:** Fostering a vibrant ecosystem for green social ventures.
  - Providing **seed funding, incubation support, and regulatory frameworks** to empower local entrepreneurs developing innovative solutions for clean energy access in rural areas.
  - These solutions might range from **micro-hydropower plants** to **community-owned solar farms**.
- **Promoting Energy Democracy:** Empowering communities and individuals to become active participants in the energy transition by encouraging **distributed generation, energy cooperatives**, and community-owned renewable energy projects.
  - Initiatives like the **Dhundi Solar Project in Maharashtra**, where a village collectively owns and operates a solar power plant, can be replicated across the country to drive **grassroots adoption of renewable energy**.
- **Embracing Circular Energy Economy:** Incorporating circular economy principles in the renewable energy sector by promoting the **reuse, repurposing, and recycling of components and materials** used in solar panels, wind turbines, and energy storage systems.
  - Companies like **Attero and Cygni Energy** are pioneering the recycling of lithium batteries that can serve as a role model.
- **Integrating Green Energy with Agriculture:** Exploring innovative solutions like **agrivoltaics**, where solar panels are installed on agricultural lands, allowing for simultaneous energy production and crop cultivation.
  - The pilot agrivoltaic project in **Jodhpur, Rajasthan** has demonstrated the potential of combining solar energy generation with sustainable agricultural practices.
- **Renewable Energy Storage Parks:** Establishing large-scale renewable energy storage parks, combining various storage technologies like **batteries, pumped hydro, and thermal storage**, to enhance grid stability and enable higher renewable energy penetration.
- **Green Gig Economy and Skill Development:** Create a vibrant "Green Gig Economy" by upskilling and reskilling the existing workforce for renewable energy jobs.
  - Utilizing online platforms like **Skill India Digital Hub (SIDH)** to connect skilled individuals with freelance work in **solar panel installation, wind turbine maintenance, and electric vehicle repair**.
  - This fosters entrepreneurship and empowers individuals to contribute to the green transition.
- **Considering the Merger of Coal and Renewable Energy Ministry:** Combine the ministries of fossil fuels and renewables into a single energy ministry will enhance coordination, integrated planning, and efficient resource allocation.
  - It will also ensure that policy decisions, like **coal expansion and renewable targets**, are aligned to achieve **long-term energy goals**.

### Drishti Mains Question:

What are the recent initiatives taken by the Indian government to promote green energy transition? Discuss the potential roadblocks in implementing these initiatives and suggest measures to overcome them.

## 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)**

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**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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