



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)

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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