# Transitioning to a Green Economy: India's Journey Toward Net–Zero Emissions by 2070

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## ABSTRACT:

India's transition toward a green economy represents a pivotal step in balancing rapid economic growth with environmental sustainability. This research paper examines India's strategies and progress in achieving its commitment to net–zero emissions by 2070. Drawing upon secondary data from government reports, international indices, and policy frameworks, the study explores the nation's efforts in renewable energy expansion, low–carbon development, and sustainable economic transformation. Key initiatives such as the National Action Plan on Climate Change (NAPCC), the Green Hydrogen Mission, and the Production Linked Incentive (PLI) scheme highlight India's integrated approach to decarbonization. The study also evaluates India's current emission profile, sectoral contributions, and energy mix to identify the major drivers and challenges in its green transition. Despite notable progress, persistent issues–such as dependence on coal, financing gaps, air pollution, and slow technology adoption–pose barriers to achieving carbon neutrality. The findings underscore the need for coordinated efforts across policy, finance, technology, and social inclusion to ensure an equitable, resilient, and sustainable low–carbon future.

## KEYWORDS:

Green Economy, Net–Zero Emissions, Sustainable Development, Renewable Energy, De–carbonization, Low–Carbon Growth.

## Introduction:

India, as one of the world's fastest–growing economies, faces the dual challenge of sustaining economic growth while mitigating climate change. Recognizing the urgent need for a sustainable development pathway, India has committed to achieving net–zero emissions by 2070, signaling a transformative shift toward a green economy. Transitioning to a green economy involves adopting low–carbon technologies, enhancing energy efficiency, promoting renewable energy, and fostering inclusive, sustainable growth across sectors such as energy, transport, industry, and agriculture. Over the past decade, India has made significant strides

in renewable energy, with capacity surpassing 220 GW, including a remarkable expansion in solar and wind power. Policy initiatives like the National Action Plan on Climate Change (NAPCC), the Green Hydrogen Mission, and the Production Linked Incentive (PLI) schemes for clean technologies reflect a comprehensive approach to decarbonization. International collaborations, including partnerships on hydrogen and clean energy, further strengthen India's global climate engagement.

**Literature Review:**

India's commitment to achieving net-zero emissions by 2070 has drawn increasing attention in both policy and academic literature, reflecting the intersection of climate responsibility, sustainable development, and economic growth. The World Economic Forum (2023) underscores the transformative potential of India's green transition, projecting that renewable energy expansion, energy efficiency improvements, and sustainable industrial practices could generate over 50 million green jobs and contribute $15 trillion to the economy by 2070. This demonstrates that decarbonization can be both environmentally necessary and economically beneficial.

The Energy and Resources Institute (TERI, 2024) highlights the need for sector-specific strategies to reduce carbon intensity across energy, transport, and industry. Key interventions include integrating renewable energy, developing green hydrogen, and electrifying transport systems. Deloitte (2023) emphasizes the magnitude of financial requirements, estimating an annual investment of $300 billion in clean energy infrastructure, which is critical for achieving decarbonization targets while simultaneously promoting industrial growth and employment generation.

Beyond technical and financial considerations, social inclusion is central to India's transition. The Asian Development Bank (ADB, 2023) stresses that a just and equitable transition requires workforce reskilling, gender-sensitive policies, and equitable access to low-carbon technologies. Similarly, IAM Consortium (2024) notes that strong policy coordination, technological innovation, and international collaboration are essential to overcome structural barriers such as coal dependence and limited green infrastructure.

Institutional and policy mechanisms play a crucial role in supporting this transition. Initiatives such as the National Action Plan on Climate

Change (NAPCC), the Production Linked Incentive (PLI) scheme for solar PV modules, and global partnerships like the Indo–German Task Force and the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) have been highlighted as instrumental in accelerating renewable energy adoption, promoting energy efficiency, and fostering innovation in green technologies (TERI, 2024; IAM Consortium, 2024). .

**Methodology:**

This study adopts a qualitative and descriptive research design to analyse India's transition toward a green economy and its strategies for achieving net–zero emissions by 2070. Secondary Data were collected from reliable sources such as government reports, official climate policy documents, renewable energy statistics, and international indices such as the Environmental Performance Index (EPI) and Climate Change Performance Index (CCPI). The data were systematically reviewed, categorized, and interpreted to identify key trends, policy interventions, and challenges.

**Objectives:**

1. To examine India's policy frameworks, initiatives, and sectoral strategies driving the transition toward a green and low–carbon economy.
2. To evaluate the challenges and opportunities in achieving India's net–zero emission target by 2070 within the context of sustainable development.

**Understanding the Concept of Green Economy:**

The concept of a green economy has evolved as a guiding framework for sustainable development, integrating economic progress with environmental stewardship and social inclusiveness. According to the United Nations Environment Programme (UNEP, 2011), a green economy is one that "results in improved human well–being and social equity, while significantly reducing environmental risks and ecological scarcities. " It emphasizes low–carbon growth, resource efficiency, and social inclusivity as the foundation of long–term prosperity. Similarly, the Organisation for Economic Co–operation and Development (OECD, 2012) defines the green economy as an approach that fosters economic growth and development while ensuring that natural assets continue to provide the resources and ecosystem services on which human well–

being depends. Unlike traditional economic models, the green economy prioritizes sustainable investments, renewable energy, and circular production systems that minimize waste and emissions. It also upholds core principles of fairness, justice, and intergenerational equity–ensuring that the pursuit of growth today does not compromise the ability of future generations to meet their own needs.

**India's Position in the Global Green Economy Framework:**

India is steadily advancing toward a green economy, underpinned by ambitious goals, policy reforms, and significant achievements in renewable energy and sustainable development. The nation's green economy is projected to attain a valuation of $1 trillion by2030 and an impressive $15 trillion by 2070, potentially generating 7. 29 million green jobsby FY28 and 35 million by 2047. India's renewable energy capacity has witnessed remarkable growth, reaching 220. 10 GW, with a record 29. 52 GW added in a single year–of which 23. 83GW was derived from solar energy alone. These milestones align with India's commitment to achieving 500 GW of non–fossil fuel–based energy capacity by 2030, consistent with its Panchamritclimate pledges.

At the international level, India continues to be acknowledged as a key player in global climate action, securing the 10th position in the 2025 Climate Change Performance Index (CCPI). This ranking reflects the country's sustained efforts toward renewable energy adoption and climate policy implementation. However, significant challenges persist, as evidenced by India's 176th rank in the 2024 Environmental Performance Index (EPI). The low ranking is primarily attributed to severe air pollution (177th in air quality), a heavy reliance on coal–based energy, and insufficient biodiversity protection measures. India also faces pressing environmental concerns, including ecosystem degradation, with a 170th rank in Ecosystem Vitality, and poor Environmental Health performance, ranked 177th, indicating the urgent need for stronger policy frameworks and technological innovation

**India's Current Emission Profile and Sectoral Contributions:**

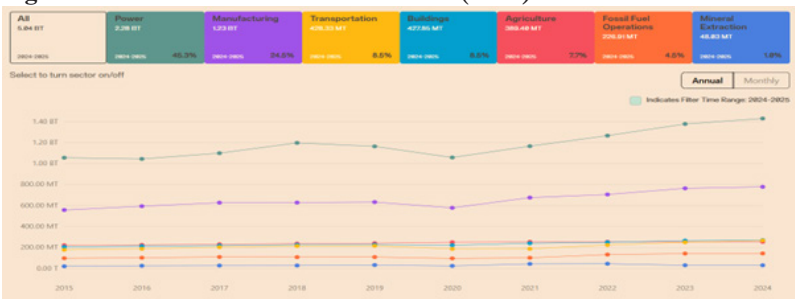
India's rapid population growth, expanding economy, and rising energy demand have driven a significant increase in its greenhouse gas emissions over recent decades. Currently, the world's most populous nation emits approximately four billion metric tonnes of carbon dioxide equivalent

(GtCO₂e) annually. According to Climate TRACE's preliminary estimates for February 2025, China remains the world's largest emitter, with total emissions reaching 1. 47 billion tonnes of $CO_2e$, marking an increase of 3. 04 million tonnes (0. 21%) compared to February 2024. The United States ranked second, recording a decline of 6. 88 million tonnes $CO_2e$ (1. 18%) year–over–year, followed by Russia in third place with a decrease of 2. 06 million tonnes $CO_2e$ (0. 63%). India stood fourth, registering a reduction of 1. 97 million tonnes $CO_2e$ (0. 63%), while Indonesia ranked fifth, with emissions falling by 0. 87 million tonnes $CO_2e$ (0. 72%) compared to the previous year.

With energy demand expected to continue rising sharply, India is projected to surpass the United States to become the world's second–largest emitter by 2035. To align with its commitment to achieving net–zero emissions by 2070, India faces the critical challenge of accelerating its clean energy transition, reducing carbon intensity, and balancing emission control with sustained economic growth.

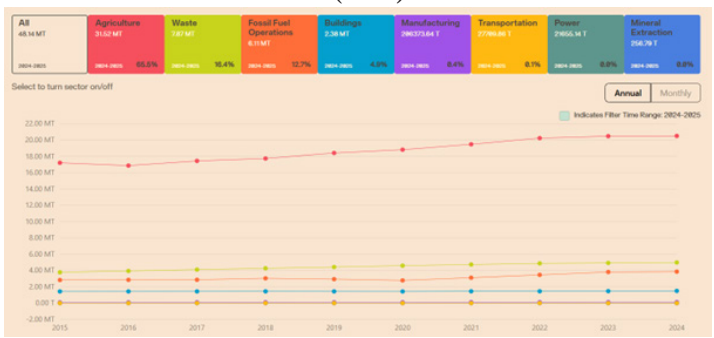
According to Climate TRACE's preliminary estimates for February 2025, among the seven major sectors of the economy, the power sector ranked first in carbon dioxide ($CO_2$) emissions, releasing 2. 28 billion tonnes (BT) of $CO_2$. In contrast, the agriculture sector was identified as the leading contributor to methane ($CH_4$) and nitrous oxide ($N_2O$) emissions, producing 31. 52 billion tonnes of methane and 915, 643. 79 tonnes of nitrous oxide, respectively. The following three figures illustrate the emission trends of carbon dioxide, methane, and nitrous oxide across the seven key sectors of the economy.

**Figure 1: Emission of Carbon Dioxide (CO2)**



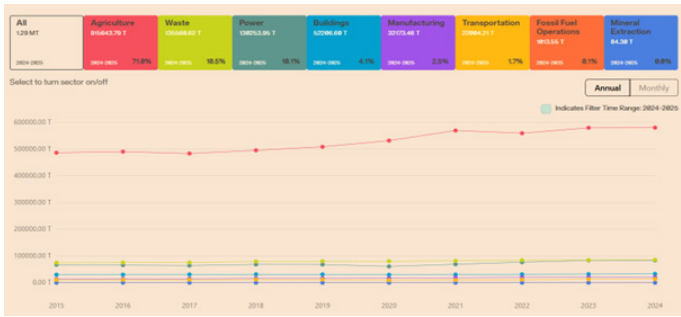

**Source:** Global Greenhouse Gas Emissions estimates for February 2025, Released by Climate TRACE

**Figure 2: Emission of Methene (CH4)**




**Source:** Global Greenhouse Gas Emissions estimates for February 2025, Released by Climate TRACE

**Figure 3: Emmission of Nitrous Oxide (N2O):**




**Source:** Global Greenhouse Gas Emissions estimates for February 2025, Released by Climate TRACE

**India's Energy Scenario:**

Recently, the Ministry of Statistics and Programme Implementation (MoSPI) has unveiled its annual publication, 'Energy Statistics India 2025', through the National Statistics Office (NSO). India's energy landscape in 2025 reflects both growing demand and a gradual transition toward cleaner energy sources.

**Total Energy Supply and Demand:**

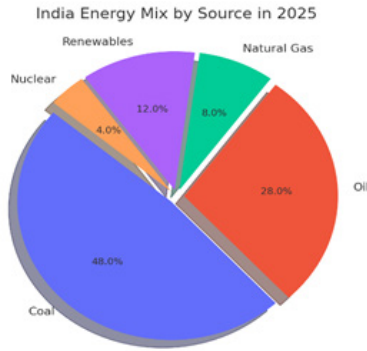
In 2025, India's total energy supply is projected to reach approximately 1, 800 million tonnes of oil equivalent (MToE), reflecting an annual growth of 4. 5% over 2024. Energy demand is predominantly driven by industrial expansion (accounting for 40% of total consumption),

followed by the transportation sector (25%) and residential use (20%), underscoring the diverse economic sectors that shape the country's energy requirements.

**Energy Mix (Sources and Shares):**

- Coal: 48% – remains the dominant source of energy, primarily for power generation and industrial use.
- Oil: 28% – largely consumed in transportation and industrial sectors.
- Natural Gas: 8% – used in power generation, fertilizer production, and residential applications.
- Renewables (Solar, Wind, Hydro, Biomass): 12% – showing steady growth as India expands its clean energy capacity.
- Nuclear: 4% – contributing to baseload power and energy security.

**Figure 4: India's energy mix in 2025**




**Source:** Energy Statistics India 2025, Released by National Statistics Office (NSO)

**India's Path in Achieving Sustainable and Low–Carbon Growth:**

To advance its commitment toward sustainable and climate–resilient growth, India has formulated the Long–Term Low Greenhouse Gas Emission Development Strategy (LT–LEDS). This strategy provides a comprehensive framework for achieving net–zero emissions by 2070, balancing developmental priorities with environmental sustainability. The LT–LEDS outlines seven key strategic transitions that collectively aim to transform India's economy into a low–carbon, climate–resilient system:

» Low carbon development of electricity systems consistent with

development

» Developing an integrated, efficient, inclusive low–carbon transport system

» Promoting adaptation in urban design, energy & material–efficiency in buildings& sustainable urbanization

» Promoting economy–wide decoupling of growth from emissions and development of an efficient, innovative low–emission industrial system

» CO2 removal and related engineering solutions

» Enhancing Forest and Vegetation cover consistent with socio–economic and ecological considerations

» Economic and financial aspects of low–carbon development and Long–Term Transition to Net–Zero by 2070.

**India's Commitment and Challenges in Achieving Low–Carbon Development:**

India faces considerable challenges arising from its large population and pressing developmental needs. Despite these constraints, the country remains firmly committed to low–carbon development and building climate resilience while addressing its unique socioeconomic circumstances.

According to the World Population Review (2025), India's historical share in global greenhouse gas (GHG) emissions grew by 6. 1% in 2023, even though the nation accounts for approximately 17. 8% of the world's population. As reported in Energy Statistics India (2025), the country's per capita energy consumption reached 18, 410 megajoules per person in 2023–24, reflecting a compound annual growth rate (CAGR) of 2. 55%, which remains significantly lower than that of most developed and developing economies.

**Climate Action Initiatives for Achieving Carbon Neutrality:**

The Government of India has proactively implemented a range of climate action initiatives to mitigate environmental challenges and promote sustainable development. These initiatives are aligned with the nation's broader goal of achieving carbon neutrality by 2070. Some of the key measures are outlined below:

**1. Forest Land Diversion and Mitigation Measures:**

**Forest Fragmentation Consideration:** The issue of forest fragmentation is carefully evaluated during the approval process for diversion of forest land for non-forestry purposes under the Forest (Conservation) Act, 1980 (Van Adhiniyam, 1980).

**Compensatory Afforestation:** Mandatory compensatory afforestation is undertaken for all non-forestry land diversions, including activities such as soil and moisture conservation and eco-restoration to offset ecological loss.

**"Ek Ped Maa Ke Naam" Campaign:** Launched on World Environment Day 2024, this nationwide tree plantation initiative encourages citizens to plant and nurture trees in honour of their mothers, fostering environmental responsibility and public participation.

**Green Credit Programme:** Introduced in 2023, this initiative promotes tree plantation on degraded forest lands to generate green credits, incentivizing sustainable practices among individuals and organizations.

**National Afforestation Programme (NAP):** A flagship pan-India initiative focusing on the restoration of degraded forest areas through community participation and decentralized forest governance mechanisms.

**2. Urban Climate Adaptation and Low-Carbon Development:**

Urban areas play a critical role in India's transition toward a low-carbon and climate-resilient future. Recognizing this, India's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) emphasizes integrating climate adaptation measures and resource efficiency into urban development frameworks to ensure sustainable growth.

**Mainstreaming Adaptation in Urban Planning:** The LT-LEDS underscores the importance of embedding adaptation strategies within urban planning policies and guidelines. These measures aim to enhance energy efficiency, resource optimization, and climate resilience in cities, which are pivotal for achieving a low-carbon development pathway.

**Sustainable Urban Planning Policies:** Several national initiatives support this transition, including the Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines, the Town and Country Planning Act, and flagship government programs such as the Smart Cities Mission, Atal Mission forRejuvenation and Urban Transformation (AMRUT), Pradhan Mantri Awaas Yojana (PMAY),

and the Swachh Bharat Mission (SBM). These initiatives collectively promote sustainable urbanization, inclusive infrastructure development, and environmentally responsible urban governance.

**Air Pollution Control and Clean Air Initiatives:**

Air pollution remains one of India's most pressing environmental challenges, significantly impacting public health, ecosystems, and economic productivity. To address this, the Government of India has launched a series of policy measures and programs aimed at reducing emissions, promoting cleaner technologies, and improving urban air quality.

**National Clean Air Programme (NCAP):** Launched as a comprehensive initiative to improve air quality across India, the NCAP focuses on the development and implementation of city-specific action plans for 131 identified non-attainment cities. The program sets targets for 20-30% reduction in $PM_{2.5}$ and $PM_{10}$ concentrations by promoting coordinated efforts among central, state, and local agencies.

**Funding and Implementation Mechanisms:** Financial and institutional support for air quality improvement is mobilized through various schemes, including the Swachh Bharat Mission (SBM-Urban), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Sustainable Alternative Towards Affordable Transportation (SATAT), Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME-II), and the Nagar Van Yojana, which collectively strengthen urban air management capacity.

**3. Coastal Ecosystem Conservation and Resilience:**

India's coastal ecosystems are highly vulnerable to climate change impacts, including sea-level rise, cyclones, and coastal erosion. To strengthen resilience and protect biodiversity, the government has implemented several targeted initiatives:

**Mangrove and Coral Reef Conservation:** Financial assistance is provided to coastal states and Union Territories (UTs) to enhance climate resilience, with a focus on mangrove conservation, habitat restoration, and ecosystem-based adaptation measures.

**Integrated Coastal Zone Management Plans (ICZMPs):** State-specific ICZMPs have been prepared for Gujarat, Odisha, and West Bengal to ensure systematic protection and sustainable management of

coastal ecosystems, including shoreline stabilization and biodiversity conservation.

**Mangrove Initiative for Shoreline Habitats and Tangible Incomes (MISHTI) Program:** Launched in 2023, this program promotes mangrove restoration and reforestation, covering approximately 540 km² across nine coastal states and four UTs. In FY 2024–25, an allocation of ₹12.55 crores was released to Gujarat, West Bengal, Kerala, and the UT of Puducherry for the restoration of 3,046 hectares of mangroves, strengthening both ecological integrity and local livelihoods.

**Major Findings:**

The study reveals that India is making significant progress toward achieving its net–zero emissions target by 2070 through comprehensive policy measures, renewable energy expansion, and sustainable development initiatives. With over 220 GW of renewable capacity, India demonstrates strong commitment to transitioning toward a green economy. Key national strategies such as the National Action Plan on Climate Change (NAPCC), the Long–Term Low Emission Development Strategy (LT–LEDS), and the Green Hydrogen Mission highlight integrated efforts to decouple economic growth from carbon emissions. Despite this progress, challenges persist, including coal dependency, inadequate green financing, air pollution, and slow technology adoption. India's position in global indices such as the Climate Change Performance Index (CCPI) and Environmental Performance Index (EPI) underscores both achievements and shortcomings. The findings emphasize that achieving sustainable, low–carbon growth requires coordinated action across policy, finance, technology, and social inclusion to ensure an equitable transition aligned with India's long–term development goals.

**Conclusion:**

India's journey toward a carbon–neutral future reflects a deep commitment to sustainable development and environmental stewardship. Through strategic initiatives such as the Long–Term Low Emission Development Strategy and the Miyawaki tree plantation at Mahakumbh 2025, the nation is fostering a balance between economic growth and ecological responsibility. The success of India's climate transition rests on the integration of the three key pillars–Coordination, Capacity, and Community. Strengthening coordinated governance at all levels, enhancing

capacity through finance, technology, and infrastructure, and fostering community–driven participation are vital steps toward resilience.

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The Authors have no conflict of interest to declare that they are relevant to the content of this article.