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Economic Growth and Sustainable Development in India: Challenges and Opportunities

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Abstract

India's development trajectory presents a central policy challenge: sustaining economic growth while improving social inclusion and reducing environmental pressure. This paper examines the relationship between economic growth and sustainable development through the perspectives of green growth, energy transition, resource efficiency, and the Sustainable Development Goals (SDGs). It adopts a descriptive, document-based approach and incorporates selected official statistics. The National Statistics Office estimated real GDP growth at 6.5% in FY 2024–25. In the electricity sector, official data show that non-fossil sources accounted for 50.08% of installed generation capacity in June 2025, while coal accounted for 72.50% of electricity generation in FY 2023–24. These indicators illustrate an economy that is expanding while its energy system undergoes a significant but incomplete transition. Installed capacity and actual electricity generation are different measures, and a higher non-fossil capacity share does not automatically imply an equivalent share of electricity generated or an immediate reduction in emissions. The paper discusses the theoretical basis of sustainable development, India's economic and energy context, structural challenges, policy opportunities, and a framework for monitoring progress. It concludes that long-term sustainability requires coordinated policy across power generation, industry, employment, resource management, and social protection. The statistical tables provide descriptive context and are not presented as causal estimates.

Keywords: *economic growth; sustainable development; green growth; renewable energy; coal dependence; SDGs; India; inclusive development.*

Introduction

India's economic expansion has created opportunities for higher incomes, infrastructure development, technological progress, and improved access to goods and services. However, the quality and distribution of growth matter as much as its aggregate rate. Economic progress must be assessed alongside employment, poverty reduction, environmental quality, public health, resource security, and the ability of future generations to meet their needs.

Sustainable development requires economic, social, and environmental objectives to be pursued together. In India, this task is shaped by rising energy demand, urbanisation, industrial expansion, transport requirements, water stress, air pollution, land-use pressures, and exposure to climate change. At the same time, the country has opportunities to expand solar and wind power, improve energy efficiency, modernise infrastructure, develop green industries, and create new employment opportunities.

The green-growth approach seeks to improve economic welfare while reducing pollution and the intensity of resource use. It does not imply that every environmental impact automatically declines as income rises. Rather, the relationship depends on policy, technology, investment, institutions, consumption patterns, and the structure of production. This paper examines these issues using a secondary-data framework and focuses particularly on the interaction between economic performance and the electricity transition.

Review of Literature and Theoretical Framework

1 Sustainable development

Sustainable development integrates economic opportunity, social equity, and environmental protection.

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The Sustainable Development Goals provide a broad framework for examining these dimensions, including clean energy, decent work, sustainable cities, responsible consumption, climate action, and reduced inequality. For India, progress cannot be measured by GDP alone because economic growth may coexist with uneven income distribution, pollution, and unequal access to essential services.

2 Green growth and decoupling

Green-growth frameworks emphasise cleaner production, renewable energy, energy efficiency, circular resource use, and the protection of natural capital. Decoupling can be described in two ways. Relative decoupling occurs when environmental pressure grows more slowly than economic output; absolute decoupling occurs when environmental pressure falls while output continues to grow. Whether either pattern occurs must be tested using consistent time-series data rather than assumed from the existence of a policy target or a rise in renewable capacity.

3 Environmental Kuznets curve

The environmental Kuznets curve hypothesis suggests that some forms of environmental degradation may rise during early industrialisation and decline after income reaches a certain level. Empirical results differ across pollutants, countries, and periods. The hypothesis should therefore be treated as a proposition to test, not a guarantee that growth will automatically resolve environmental problems.

4 Energy-growth relationship

Energy is an input into manufacturing, transport, construction, digital services, and household welfare. A reliable and affordable electricity supply can support productivity, but fossil-fuel-intensive generation can also contribute to air pollution and greenhouse-gas emissions. The policy challenge is to expand clean electricity, transmission, storage, and efficiency while maintaining reliability and affordability during the transition.

Objectives of the Study

1. To examine the relationship between economic growth and sustainable development in India.
2. To review the role of green growth and the SDGs in national development planning.
3. To present selected official statistics on GDP growth and the electricity transition.
4. To identify challenges associated with fossil-fuel dependence, inequality, employment, and resource pressure.
5. To assess opportunities for renewable energy, efficiency, green investment, and inclusive development.
6. To propose a data-based framework for monitoring sustainable development.

Research Methodology

The study uses a qualitative, document-based and descriptive analytical approach. It draws on the themes and references in the supplied manuscript and supplements them with selected official Indian statistical releases. The main indicators used for illustration are real GDP growth, the share of non-fossil sources in installed electricity capacity, and the share of coal in electricity generation.

The indicators refer to different reporting periods and measure different aspects of the economy. GDP growth is a macroeconomic flow measure; installed capacity describes the maximum rated generation capacity available; and generation share measures electricity actually produced over a period. They should not be combined as if they were equivalent variables or used alone to infer causation.

A full empirical study could build a consistent annual dataset covering GDP, sectoral value added, employment, inequality, electricity generation by source, emissions intensity, renewable capacity, energy imports, water stress, and forest-resource indicators. Trend analysis, index construction, correlation, and regression may then be applied, with definitions and limitations reported clearly. This paper does not claim to estimate a causal model from the small set of descriptive figures presented.

Statistical Overview of India's Economic and Energy Transition

The official data below provide a quantitative starting point for evaluating the opportunities and challenges of sustainable development. Each table identifies its source immediately beneath the table.

Table 1. Real GDP growth in India

Financial year	Real GDP growth	Status of estimate
2023–24	9.2%	First Revised Estimate cited in the May 2025 release
2024–25	6.5%	Provisional Estimate released 30 May 2025

Data Source: *National Statistics Office, Ministry of Statistics and Programme Implementation, "Provisional Estimates of Annual GDP for 2024–25," Press Information Bureau, 30 May 2025: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2132688*

Note: Rates are at constant prices and follow the estimate status specified in the release. GDP growth measures aggregate economic output and is not, by itself, a measure of sustainability or equitable welfare.

Table 2. Non-fossil share of India's installed electricity capacity

Reference date	Total installed capacity	Non-fossil capacity	Non-fossil share
30 June 2025	484.82 GW	242.78 GW	50.08%

Data Source: *Government of India, Ministry of Power, "Energy Transition and Renewable Capacity," Press Information Bureau, 16 March 2026: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2240737*

Note: Non-fossil capacity includes renewable sources and nuclear power. Installed capacity is not the same as actual electricity generation because capacity factors and dispatch patterns differ by technology.

Table 3. Share of electricity generation by selected sources

Source	2018–19	2021–22	2022–23	2023–24
Coal	71.77%	69.81%	70.54%	72.50%
Natural gas	3.62%	2.41%	1.47%	1.80%
Hydro	9.80%	10.16%	9.98%	7.71%
Renewable energy (wind, solar, biomass, bagasse, small hydro and others)	9.21%	11.46%	12.53%	12.99%

Data Source: *Government of India, Ministry of Power, parliamentary response annexure, "Percentage of Electricity Generated From Various Sources," year-wise generation 2018–19 to 2023–24: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2041641*

Note: Values are generation shares as reported in the source table. The renewable category is shown separately from conventional hydro/nuclear categories as presented in that release; category definitions should be checked before comparing with other datasets.

Interpretation of the Statistical Evidence

The GDP estimates indicate continued expansion in FY 2024–25, with real GDP growth reported at 6.5%. This provides a macroeconomic context for the sustainability question: the issue is not simply whether India grows, but whether the structure of growth improves livelihoods while reducing environmental pressure per unit of output and, where feasible, in absolute terms.

The installed-capacity data show that non-fossil sources crossed half of total installed electricity capacity by June 2025. This is an important capacity milestone, but capacity alone does not indicate the quantity of electricity generated. Solar and wind output varies with weather and time of day, while thermal plants may operate at different utilisation levels. Transmission, storage, flexible generation, demand management, and grid reliability influence how installed capacity translates into actual power supply.

The generation data show that coal remained the largest source of electricity in FY 2023–24, contributing 72.50% in the cited official series. The renewable-generation share rose from 9.21% in 2018–19 to 12.99% in 2023–24 in the same table. These figures indicate progress in renewable generation alongside continued dependence on coal. Because the shares are compositional, changes in one source may reflect changes in other sources as well as changes in total demand.

Taken together, the indicators suggest that economic growth and clean-energy expansion are occurring alongside persistent fossil-fuel dependence. They do not prove that growth has been fully decoupled from environmental degradation. Demonstrating decoupling would require consistent data on GDP and environmental indicators, such as emissions or resource use, over the same period.

Major Challenges to Sustainable Development

1 Fossil-fuel dependence and emissions

Coal continues to play a major role in electricity generation. This creates a transition challenge because electricity demand is expected to rise with urbanisation, industrialisation, digital infrastructure, cooling, and transport electrification. A rapid shift requires clean generation to be complemented by transmission investment, storage, flexible demand, grid modernisation, and a plan for workers and regions dependent on fossil-fuel industries.

2 Employment and distribution of growth

Aggregate GDP growth does not ensure that the benefits are evenly distributed. Sustainable development requires productive employment, skills, access to quality education and healthcare, and opportunities for women and disadvantaged communities. Green industries may create new jobs, but workers need training and geographic mobility support to access them. Policy evaluation should therefore track job quality and distribution as well as investment totals.

3 Air pollution and public health

Air pollution imposes costs through illness, lost productivity, and reduced quality of life. Cleaner electricity, transport, industrial processes, and cooking fuels can deliver climate and health benefits. However, pollution sources differ by region and sector, so monitoring and enforcement should be designed around local conditions.

4 Water, land, and ecosystem pressures

Economic activity places pressure on freshwater, land, forests, minerals, and biodiversity. Renewable infrastructure also requires careful siting and

resource planning. Sustainable development therefore requires environmental assessment, water-use efficiency, circular material flows, restoration of degraded ecosystems, and coordination across sectors.

5 Investment and institutional coordination

The transition requires large and sustained investments in generation, transmission, storage, industrial efficiency, public transport, buildings, and resilient infrastructure. Fragmented planning can lead to bottlenecks or conflicting incentives. Clear regulation, stable financing, transparent data, and coordination between national and state institutions are essential.

Opportunities for Green and Inclusive Growth

1 Renewable energy and grid modernisation

Solar, wind, hydro, and other low-carbon sources can reduce dependence on fossil fuels when deployed with suitable grid and storage infrastructure. Manufacturing, installation, operation, and maintenance can create economic opportunities. The transition should be assessed on affordability, reliability, land and water impacts, domestic supply chains, and lifecycle environmental performance.

2 Energy efficiency

Efficiency improvements in buildings, appliances, industry, agriculture, and transport can reduce energy costs and emissions while supporting productivity. Standards, audits, financing, public procurement, and information programmes can help overcome barriers to adoption.

3 Green industry and circular economy

Cleaner production, recycling, repair, material recovery, and efficient industrial processes can reduce resource intensity and create new business opportunities. Sectors such as steel, cement, chemicals, and freight require tailored pathways because their emissions and technology constraints differ from those of electricity generation.

4 Sustainable agriculture and rural development

Water-efficient irrigation, renewable-powered pumps where appropriate, soil conservation, climate-resilient practices, and improved supply chains can support rural livelihoods. Programmes should consider local water availability and avoid incentives that unintentionally increase groundwater extraction.

5 Digital systems and public accountability

Digital monitoring can improve energy management, public-service delivery, resource tracking, and programme evaluation. Reliable, open, and comparable data help policymakers assess progress and allow citizens to understand whether commitments are translating into measurable outcomes.

Sustainable Development Goals and Policy Alignment

The topic is closely linked with SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 10 (Reduced Inequalities), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 15 (Life on Land). These goals are interdependent. For example, expanding renewable electricity supports climate action, but its broader development value also depends on access, affordability, job quality, land use, and the reliability of supply.

India's net-zero target for 2070 and its climate commitments provide long-term direction, but progress should be evaluated through transparent indicators and interim milestones. Policy targets are not the same as outcomes: the assessment should track both the implementation of measures and the resulting changes in emissions, energy access, employment, resource use, and public welfare.

Proposed Monitoring Framework

Table 4. Indicators for an integrated sustainable-development dashboard

Dimension	Suggested indicators	Possible official source
Economic growth	Real GDP growth; sectoral GVA; labour productivity	MoSPI / National Statistics Office
Employment and inclusion	Employment rate; female labour-force participation; income distribution measures	MoSPI and relevant official labour/household surveys
Energy transition	Installed capacity and generation by source; transmission and storage indicators	Ministry of Power; Central Electricity Authority; MNRE
Climate and emissions	Greenhouse-gas emissions; emissions intensity; air-quality indicators	MoEFCC; CPCB; official inventory publications
Resource efficiency	Energy intensity; water withdrawals; material use; waste recovery	Relevant ministries and official statistical publications
Natural capital	Forest cover; ecosystem condition; biodiversity and restoration indicators	Forest Survey of India and relevant environmental agencies
Social outcomes	Access to clean energy, health, education, sanitation, and essential services	MoSPI and responsible line ministries

Data Source: *Data Source: Proposed indicator mapping compiled for this paper. The table identifies datasets to consult and does not contain measured values. Exact publication, series, reference period, and definitions should be documented during data collection.*

Discussion

The evidence points to a transition challenge rather than a simple choice between growth and the environment. India needs reliable and affordable energy to support industry, public services, and household welfare. At the same time, continued dependence on coal creates environmental and health costs. Renewable capacity expansion is important, but the outcome depends on the share of actual generation, the integration of variable sources, and the reduction of emissions across the wider economy.

A balanced strategy should align energy planning with employment, industrial policy, public health, and natural-resource management. Investment in clean technologies can support competitiveness and energy security, while worker-transition programmes and targeted social protection can help ensure that the costs of change are not concentrated on vulnerable households or regions.

The results also demonstrate the importance of measurement discipline. Installed capacity, electricity generation, GDP growth, emissions, and social welfare are distinct indicators. They should not be used interchangeably. Claims about decoupling should be supported by matched time-series evidence and clearly defined environmental outcomes. A more complete study could use annual data from 1990 onward, as proposed in the supplied manuscript, while checking for consistency in national accounting, sectoral classifications, and environmental reporting.

Recommendations

1. Expand renewable generation alongside transmission, storage, grid flexibility, and demand-side management.
2. Improve energy efficiency in industry, buildings, appliances, agriculture, and transport.
3. Plan a just transition for workers and communities that depend on high-carbon industries.
4. Strengthen clean-air policies and integrate public-health outcomes into energy and industrial planning.
5. Use water, land, and biodiversity safeguards when siting infrastructure and promoting industrial development.
6. Support green manufacturing, circular-economy activity, research, and skill development.
7. Track GDP, employment, inequality, energy generation, emissions, and resource use through a common monitoring framework.
8. Publish transparent metadata and place exact data-source notes directly below every statistical table.
9. Evaluate policies using measurable outcomes rather than relying solely on targets, installed capacity, or announced investment.
10. Improve coordination between central and state governments, regulators, industry, research institutions, and local communities.

Limitations of the Study

- The study is based on secondary documents and a small set of official descriptive indicators rather than a newly estimated econometric dataset.
- The reported statistics refer to different periods and measures; they are not directly comparable as a single time series.
- Installed capacity does not measure actual generation, and neither indicator alone establishes the change in emissions.
- The supplied manuscript contains references and claims that should be independently checked against the full publications before formal submission.
- Causal conclusions about growth and environmental degradation require consistent data, model specification, and appropriate statistical testing.

Conclusion

India's pursuit of sustainable development depends on whether economic growth can be combined with social inclusion and lower environmental pressure. The official figures reviewed here show real GDP growth of 6.5% in FY 2024–25 and a non-fossil share of installed electricity capacity above 50% by June 2025. Yet coal still supplied 72.50% of electricity generation in FY 2023–24 in the cited official series. These statistics capture both progress and the scale of the remaining transition challenge.

The shift toward sustainable development requires more than an increase in renewable capacity. It needs reliable clean power, energy efficiency, industrial decarbonisation, effective pollution control, resource conservation, quality employment, and protection for communities affected by structural change. These measures should be designed as a connected policy system rather than separate sectoral initiatives.

Finally, claims of green growth and decoupling must be demonstrated through transparent, consistent data. An integrated monitoring framework that combines economic, environmental, and social indicators can help policymakers identify trade-offs, evaluate programmes, and adjust policy over time. Such an approach offers a stronger foundation for a more resilient, inclusive, and environmentally sustainable development pathway for India.

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Conflicts of interest

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