

# Carbon Emissions Crisis in India: An Urgent Need to Mitigate for Sustainable Development

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**Abstract:** *Carbon emissions are the most harmful, threatening the environment across all spheres, especially in sustainable development. Carbon dioxide (CO<sub>2</sub>) and other greenhouse gases produced by industrialization, energy production, and land-use changes are the main drivers of global warming. The carbon emissions crisis has emerged as a defining challenge of global sustainability, intensifying climate change and threatening economic and social stability. Rising greenhouse gas levels demand urgent mitigation strategies that balance environmental responsibility with development needs.*

*The adoption of renewable energy, energy efficiency, sustainable transportation, and carbon capture technologies is an example of strategies that offer workable ways to lower emissions while promoting long-term growth. However, to guarantee collective action, corporate responsibility, policy frameworks, and individual behavioural adjustments are crucial. This paper focuses on carbon mitigation not merely as an environmental necessity but as a strategic enabler of sustainable development. By aligning mitigation efforts with the United Nations Sustainable Development Goals (SDGs), societies can reimagine growth models that prioritize resilience, innovation, and equity. This study is necessary to examine the sources and impacts of carbon emissions in India and to analyze effective mitigation strategies that can support sustainable development.*

**Keywords:** Carbon Emission, Sustainable Development, Greenhouse gases, Carbon Mitigation.

## I. INTRODUCTION

The global carbon emissions crisis is one of the most significant environmental challenges threatening sustainable development. Carbon dioxide (CO<sub>2</sub>) and other greenhouse gases produced by industrialization, energy production, and land-use changes are the main drivers of global warming. According to the Intergovernmental Panel on Climate Change, global

greenhouse gas emissions reached around 56 giga tonnes of CO<sub>2</sub>-equivalent per year during 2010–2019, the highest level in human history. Experts say, if emissions continue at current levels, global temperatures could increase by 2.2–3.5°C by 2100, far exceeding safe climate thresholds. Therefore, mitigation strategies are essential for achieving sustainable development. According to UNEP's Emissions Gap Report 2025, global greenhouse gas emissions hit a new record high in 2024. While the IPCC stipulates that emissions must peak before 2025 and decline ~43% by 2030 to limit warming to 1.5°C, current trends indicate a rise in emissions, and an "off-track" scenario leading toward 2.8°C warming. As of early 2026, the IPCC is in its seventh assessment cycle (AR7), with experts drafting reports that emphasize the need for rapid, deep greenhouse gas emission reductions to limit global warming to 1.5°C. Global temperatures are projected to remain at record levels from 2025–2029, making the 1.5°C overshoot likely. Mitigating carbon emissions is a crucial part of this change. Strategies that provide practical solutions to reduce emissions while fostering long-term growth include the use of renewable energy; energy efficiency, sustainable transportation, and carbon capture technologies. However, corporate accountability, policy frameworks, and individual behavioural changes are essential to ensure collective action.

## II. NEED FOR THE STUDY

India is one of the fastest-growing economies in the world, experiencing rapid industrialization, urbanization, and population growth. While this development has contributed significantly to economic progress, it has also resulted in increasing carbon emissions, mainly from energy production,

transportation, industry, and agriculture. As a result, India faces serious environmental challenges such as air pollution, rising temperatures, extreme weather events, and ecological degradation. The growing carbon emissions crisis poses a major threat to environmental sustainability, public health, and long-term economic stability. Climate change impacts such as floods, droughts, heat waves, and declining agricultural productivity are becoming more frequent, affecting vulnerable communities and ecosystems across the country. These challenges highlight the urgent need to reduce carbon emissions while continuing to support economic development.

Mitigation strategies such as renewable energy expansion, energy efficiency improvements, sustainable transport systems, and carbon management policies are increasingly recognized as essential tools for addressing this crisis. India has also committed to global climate goals and is actively working toward reducing emissions and promoting green growth. Therefore, this study is necessary to examine the sources and impacts of carbon emissions in India and to analyze effective mitigation strategies that can support sustainable development. Understanding the relationship between carbon mitigation and sustainable growth will help policymakers, researchers, and stakeholders design better strategies to balance economic progress with environmental protection.

### III. OBJECTIVES OF THE STUDY

- To analyse the trends and major causes and sources of carbon emissions in India
- To put forth a strategy framework that emphasises carbon mitigation as a driver of sustainable growth and resilience.
- To recommend actionable measures for transition to low-carbon economies

### IV. KEY FINDINGS OF THE STUDY

#### OBJECTIVE NO:1

#### TO ANALYSE THE TRENDS AND MAJOR CAUSES AND SOURCES OF CARBON EMISSIONS IN INDIA

India is the 3rd largest carbon dioxide (CO<sub>2</sub>) emitter in the world, after China and the United States. India

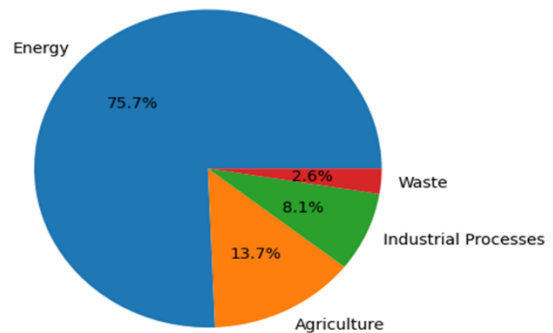
produces about 3.9 billion tonnes of CO<sub>2</sub>-equivalent emissions annually. Per-capita emissions are relatively low, around 2.07 tons per person in 2023, compared with many developed countries. The rapid increase in greenhouse gas emissions from energy production, industry, transportation, and agriculture has intensified global warming and environmental degradation. Globally, humans release over 40 billion tonnes of carbon dioxide annually, making climate change one of the most urgent challenges of the 21st century.

These emissions contribute to rising temperatures, extreme weather events, biodiversity loss, and economic instability. China and India were the global leaders in rising power sector emissions for almost ten years. China's electricity industry saw a 53.7% growth in emissions between 2015 and 2024, compared to 34.6% in India. But a change occurred in 2025.

#### Major Sources of Carbon Emissions in India (Approximately)

Sector	Share of Emissions (%)
Energy (electricity, coal, fuel)	75.66
Agriculture	13.72
Industrial processes	8.06
Urbanisation & Waste	2.56

Carbon Emission Sectors in India

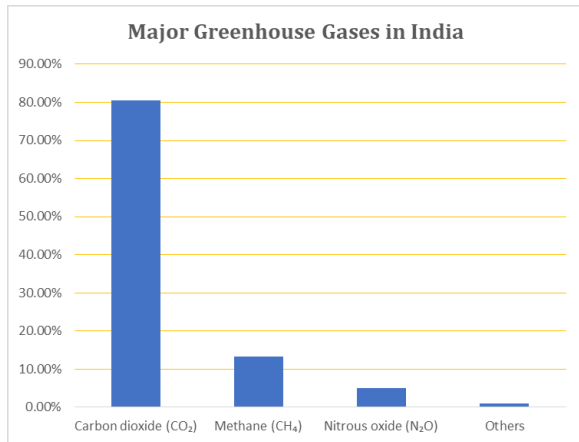


According to the above table, the energy sector, which produces almost two billion metric tonnes of CO<sub>2</sub> in 2023, accounts for 75% of carbon emissions? The primary driver of these emissions is coal. Approximately 14% of carbon emissions come from agriculture. Livestock, methane emissions, rice farming, and fertiliser use are the main causes. More than 54% of agricultural emissions come from livestock alone. Approximately 8% of the country's

emissions come from industries like manufacturing, steel, cement, and chemicals. Due to increased automobile use, road freight transportation, and rapid urbanisation, transportation emissions are rising. An important portion of emissions from the energy sector are caused by road transport. Increased usage of appliances and cooling systems, construction pollution, and electrical demand are all consequences of urban expansion. The demand for energy in cities is growing quickly as a result of economic expansion and population growth.

Major Greenhouse Gases in India

Gas	Share
Carbon dioxide (CO <sub>2</sub> )	80.53%
Methane (CH <sub>4</sub> )	13.32%
Nitrous oxide (N <sub>2</sub> O)	5.13%
Others	1.02%



About 81% of greenhouse gas emissions in India are caused by carbon dioxide (CO<sub>2</sub>). Methane (CH<sub>4</sub>) makes up about 13 percent. Nitrous oxide (N<sub>2</sub>O) makes up around 5% of this, and 1% of additional greenhouse gases emitted from various sources. India's emissions mainly come from energy production, agriculture, and industry, largely driven by coal-based electricity generation and rapid economic growth. According to 'Climate TRACE' data, India recorded the largest drop in greenhouse gas emissions among major economies in 2025, driven by a 2.6% decline in its power sector emissions, marking a significant shift after rapid growth from 2015–2024. Increased renewable energy deployment facilitated this decline, resulting in the largest reduction in power sector pollution seen since the tracking began

However, the country is expanding renewable energy and aims to achieve net-zero emissions by 2070.

**CARBON EMISSION CRISIS:**

According to the Global Carbon Project (GCP) 2025 report, India's carbon dioxide emissions from fossil fuels are expected to climb by just 1.4% in 2025, a significant reduction from the 4% increase projected in 2024. Trends in Emissions in India: From 3.19 billion tonnes in 2024 to 3.22 billion tonnes in 2025, emissions are predicted to rise. India has the second-lowest per-capita emissions among the 20 biggest economies, at 2.2 tonnes annually. India's CO<sub>2</sub> emissions are still mostly caused by coal. With 3.2 billion tonnes of carbon emissions per year in 2024, India is the third-largest carbon emitter behind China (12 billion tonnes) and the United States (4.9 billion). Between 2005 and 2014, India's yearly emission growth was 6.4%; however, between 2015 and 2024, it fell to 3.6%, indicating improvements in carbon intensity and expanding renewable capacity.

**Global Emission Trends:**

Fossil fuel emissions are anticipated to increase by 1.1% globally this year, hitting a record 38.1 billion tonnes. With coal up 0.8%, oil up 1%, and natural gas up 1.3%, global fossil CO<sub>2</sub> emissions are expected to increase across all main fuels in 2025. Global emissions have not started to decrease even after years of climate action. It is anticipated that CO<sub>2</sub> emissions resulting from land-use change (deforestation, degradation) will somewhat decrease. However, the overall amount of CO<sub>2</sub> emissions worldwide (from land use and fossil fuels) is stagnant at about 42 billion tonnes, which is comparable to 2024.

**Carbon Budget and Climate Risks:**

With approximately 170 billion tonnes of CO<sub>2</sub> left (about four years' worth of emissions at 2025 levels), the study cautions that the carbon budget—the maximum amount of CO<sub>2</sub> we can produce while still keeping warming below 1.5°C—is nearly depleted. According to scientists, maintaining a temperature below 1.5°C is no longer feasible given the current rate of emissions, and climate change is already impairing the capacity of land and ocean carbon sinks to absorb CO<sub>2</sub>.

## FACTORS CONTRIBUTING TO INDIA'S SLOWDOWN IN CARBON DIOXIDE EMISSIONS:

- **Role of Weather Conditions:** A strong and early monsoon in 2025 reduced the need for cooling and lowered irrigation demand, easing pressure on power generation and slowing the rise in fossil-fuel emissions.
- **Renewable Energy Expansion:** Rapid growth in solar and wind power added clean electricity to the grid, reducing reliance on coal and helping keep CO<sub>2</sub> emissions in check.
  - As per International Renewable Energy Agency (IRENA) RE Statistics 2025, India ranks 4th globally in total renewable capacity, 4th in wind power, and 3rd in solar power, reflecting the scale and speed of its energy transition.
  - Renewables now account for 50.07% of India's total installed power capacity (484.82 GW), achieving the COP26 non-fossil target five years ahead of schedule.
- Non-fossil capacity has risen to 242.8 GW, moving India steadily toward the 500-GW target for 2030.
- **Coal Consumption Trends:** Coal use grew only marginally in 2025, and India's power-sector CO<sub>2</sub> emissions fell by 1% year-on-year in the first half of 2025 due to strong clean-energy additions and lower overall power demand.
  - Lower cooling needs and higher renewable generation helped India avoid the usual spike in coal consumption that typically pushes emissions upward.
- **Economic and Structural Factors:** Improvements in energy efficiency and cleaner technologies have reduced the carbon intensity of the economy, while a larger economic base naturally slows percentage growth in emissions.

## OBJECTIVE NO: 2

### STRATEGIES TO MITIGATE CARBON EMISSIONS

Carbon emission mitigation refers to strategies and actions aimed at reducing greenhouse gas emissions or enhancing carbon absorption to slow climate change.

Mitigation strategies include:

- Transition to renewable energy

- Energy efficiency improvements
- Sustainable agriculture
- Carbon capture technologies
- Reforestation and ecosystem restoration

These strategies support sustainable development, which balances economic growth, environmental protection, and social well-being.

Climate change mitigation (or decarbonisation) is an action to limit the greenhouse gases in the atmosphere that cause climate change. Climate change mitigation actions include conserving energy and replacing fossil fuels with clean energy sources.

#### 1. Transition to Renewable Energy

- Solar, wind, hydro, and geothermal power replace fossil fuels, cutting emissions from electricity generation.
- India, especially Tamil Nadu, is a leader in wind energy capacity, with strong potential for rooftop solar in urban areas.

#### 2. Energy Efficiency Improvements

- Upgrading appliances, industrial machinery, and buildings reduces energy demand.
- Smart grids and AI-driven energy management optimize consumption.
- Programs like UNEP's efficiency initiatives encourage industries to adopt cleaner technologies.

#### 3. Sustainable Transportation

- Electrification of public transport (metro, buses, trains) reduces reliance on diesel and petrol.
- Expansion of EV infrastructure, including charging stations, is critical.
- Non-motorized transport (cycling, walking) lowers emissions while improving health.

#### 4. Land Use & Forestry

- Afforestation and reforestation projects absorb CO<sub>2</sub> from the atmosphere.
- Protecting forests, mangroves, and wetlands enhances biodiversity and carbon sequestration.
- Sustainable agriculture (crop rotation, reduced fertilizer use, organic farming) lowers methane and nitrous oxide emissions.

5. Carbon Capture, Utilization, and Storage (CCUS)
  - Technologies capture CO<sub>2</sub> from industrial sources and store it underground or convert it into useful products.
  - Cement and steel industries are testing CCUS to reduce their heavy emissions footprint.
  - Still expensive, but critical for hard-to-abate sectors.
6. Circular Economy & Lifestyle Changes
  - Reduce, reuse, recycle to minimize waste and emissions.
  - Shifting to plant-based diets reduces methane emissions from livestock.
  - Consumer behaviour changes—like choosing sustainable products—play a major role.

OBJECTIVE NO: 3  
ACTIONABLE MEASURES FOR TRANSITION  
TO LOW-CARBON ECONOMIES

Governments

- Need to implement carbon taxes and subsidies for clean energy.
- India is transitioning from carbon subsidies to an implicit carbon tax system, utilizing coal cess (now GST compensation cess) and high excise duties on petroleum to fund clean energy. Clean energy subsidies rose 31% to nearly ₹32,000 crore in 2023–24, while fossil fuel subsidies dropped 12%, though fossil fuel support remains roughly five times higher than clean energy.
- To strengthen climate governance institutions.
  - To invest in public transport and green infrastructure.

Businesses

- To adopt science-based emission reduction targets.
- Transition supply chains to renewable energy.
- Innovate in sustainable product design and circular economy models.

Individuals

- To reduce energy consumption through efficiency and lifestyle changes.
- To support sustainable products and services.

- To engage in community-level climate initiatives.
- Carbon Emission Protecting Innovations

V. CONCLUSION

As we said, due to rapid industrialization, urbanization, and growing energy demand, the carbon emissions crisis leads to a major environmental challenge in India. Growing emissions have an impact on ecosystems, public health, and economic stability by contributing to climate change, air pollution, and environmental degradation. Effective mitigation techniques are crucial to addressing this problem, including the use of green technologies, energy efficiency, sustainable transportation, and renewable energy. Reducing emissions also requires strong government regulations, corporate accountability, and public knowledge. By implementing these measures, India can balance economic growth with environmental protection and move toward sustainable development and a low-carbon future.

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