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The Disconnect Between Carbon Reduction Efforts and Environmental Outcomes: An Analytical Study

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Abstract

Greenhouse gases (United Nations Environment Programme, 2023) pose a major threat to the world, the effects of which are tangible in our environment. The government is taking the initiative to reduce such emissions and become a net-zero country. Though, the government's effort alone wouldn't be enough. Initiative by every citizen is also crucial in contributing towards reduced emissions. Individuals, as a result, should also adopt environmentally friendly products and practices. Businesses must work on initiatives that help the environment. This will help us understand why there hasn't been any significant change in carbon emissions (Choudhury et al., 2023) despite the government's extensive initiatives.

Introduction

Carbon emissions (Choudhury et al., 2023) have become a great public concern in today's time. Increased awareness among people has prompted governments and companies to work towards environmental sustainability. One of the main challenges being faced by the world today is global warming (IPCC, 2023). Greenhouse gases (GHGs) trap and absorb the radiation from sunlight, which in turn warms the Earth. These gases are essential to some extent for making the Earth a livable place. However, an excess of such gases leads to global warming. Carbon dioxide (CO₂), methane (World Bank, 2022), nitrous oxide, chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons, SF₆, and NF₃ are the primary greenhouse gases (United Nations Environment Programme, 2023) responsible for global warming. While water vapour contributes to global warming, it is not the primary factor.

Carbon dioxide (Ritchie & Roser, 2023) is the primary contributor to global warming, while methane emissions account for the remaining portion. The majority of carbon dioxide emissions come from the burning of fossil fuels. The emitted carbon dioxide takes thousands of years to be absorbed by the planet, while methane remains in the atmosphere for an average of only 10-12 years. Addressing this pressing issue is a collective responsibility, and the public is actively taking action to resolve it. Over the years, there has been a significant evolution in how people address this problem. In the 1900s, this term was virtually unknown due to the low level of industrial activity (Smith & Zhao, 2021), the absence of innovations, and the infrequent occurrence of major technological disruptions. After globalisation took over the world, people yearned for new and affordable products manufactured by massive industrial machines that burned fossil fuels (IEA, 2024). These emissions over a long period, led to global warming as we know it today. In the early 2000s, British Petroleum hired Ogilvy & Mather, a public relations firm, to advance the idea that people, not oil firms, are to blame for climate change (World Resources Institute, 2023; United Nations, n.d.). This is where the phrase "carbon footprint" (Solnit, 2021) gained popularity. In 2004, the company released its "carbon footprint calculator," which allowed users to calculate how much carbon they emit on a daily basis. However, in a society that is heavily dependent on fossil fuels, even a person without a job, a home, or a car will still have a significant carbon footprint. Researchers at MIT discovered that even after a few years, an impoverished person in the United States who sleeps in homeless shelters and eats in soup kitchens will still indirectly release approximately 8.5 tons of carbon dioxide annually.

According to a 2022 report, India is ranked as the third-largest global carbon-emitting country, with a staggering 2516.967 Mt CO₂. This is followed closely by China, which contributes 10613.171 Mt CO₂, and the United States, which adds 4607.592 Mt CO₂ to the global carbon footprint. (*India - Countries & Regions - IEA, n.d.*). The increasing greenhouse gas emissions have profound consequences, which include intensified storms and droughts, changes in ocean acidity, loss of biodiversity, and increased health risks.

To prevent this issue from escalating further, people have come up with solutions such as using energy-efficient air conditioning, checking energy labels, purchasing locally sourced produce, adopting circular economy practices, using responsible transportation (US EPA, 2025), utilizing renewable energy sources (World Economic Forum, 2024), planting more trees, switching to LED lighting, calculating their environmental impact through various websites and apps, and using bicycles. However, these solutions cannot be implemented and create economic, social and cultural challenges to ordinary people. As a result, they are not being implemented and are not stemming the required change.

Jevons Paradox

Jevons Paradox was introduced by William Stanley Jevons in 1865 and was later referenced by Stern in 2022. This paradox poses a significant challenge to the currently proposed solutions to reduce carbon emissions. This paradox throws light on insights into energy-efficient solutions that fail to achieve their desired outcome. This arises when the technological advancements improve resource utilisation and result in reduced cost per unit of consumption. This makes consumers more likely to consume more resources rather than leading to the desired results.

In the case of automobiles, Enhanced fuel efficiency results in a lower cost per kilometre travelled, which makes consumers more likely to travel more often or over greater distances, resulting in increased total fuel consumption.

Research depicts the rebound effect, that is, improvements in resource utilisation lead to more emissions of carbon dioxide. This triggers a Backfire Phenomena where the expense of fuel consumption exceeds the benefit realised from improved fuel efficiency. This creates a hurdle to relying solely on technological efficiency to curb carbon emissions. To effectively reduce emissions, certain things need to be executed by demand-side policies, including carbon pricing mechanisms, cap-and-trade systems, or conservation standards. These policies increase the expense of resource utilisation, thereby combating this paradox and achieving the desired results.

Literature Review

In 2023, Global emissions rose to 37.4 billion tonnes. This Statistical concern poses a significant disparity between the initiatives and the desired results, which

does not withstand years of government initiatives. Although carbon emission mechanisms demonstrate decreased emissions by 5-21%, only 21 of the 73 global schemes examined have undergone rigorous evaluation. As a result, the efficacy of such schemes remains uncertain. Existing policies are not adequate to achieve the Paris Agreement objectives; as a result, an increase in global temperature of 2.6°C is anticipated. This rise is very evident because there is a significant difference: between commitments and policies formed, between policies and their execution, and between execution and results. Main discrepancy in implementing these policies is the injudicious policies, feeble implementation, and lack of performance where technology fails to meet expectations.

2.1 Current situation of global carbon emissions



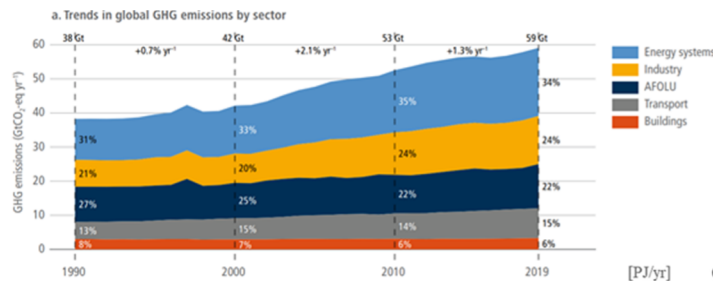
Source: IEA (2025), annual change in energy-related CO₂ emissions, 1900-2024.



Source: IEA (2025), Global CO₂ emissions from energy combustion and industrial processes and their annual change

Carbon emissions are rising every year and therefore pose a significant threat to the world. During the COVID-19 pandemic in 2020, we observed a decline in carbon emissions. This period restricted human activities, leading to a reduction in carbon emissions. However, after the pandemic, we witnessed a surge in emissions. This surge is attributed to the increasing industrial activities and rapid development of countries, which are demanding more energy and burning more fossil fuels.

2.2 Global emissions by sector

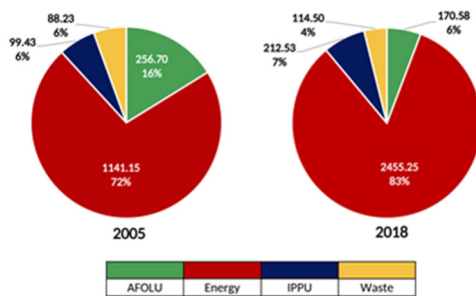


Source: Data from IPCC (2022); based on global emissions from 2019, details on the sectors and individual contributing sources can be found in the Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Mitigation of Climate Change, Chapter 2.

There's a rise in carbon emissions in the energy and industrial sectors, while AFOLU (Agriculture, Forestry, and Other Land Use), Transport, and Buildings show a slight decline. This increase in emissions from the energy and industrial sectors indicates the rapid development of the countries.

2.3 Sector-wise Carbon Emissions in India

Figure 2: Sector-wise Contribution (Mt CO₂e) and Percentage Share in Net Economy-wide GHG Emissions of India



Source: GHG Platform India. (n.d.). Analysis of Greenhouse Gas Emissions from 2005 to 2018.

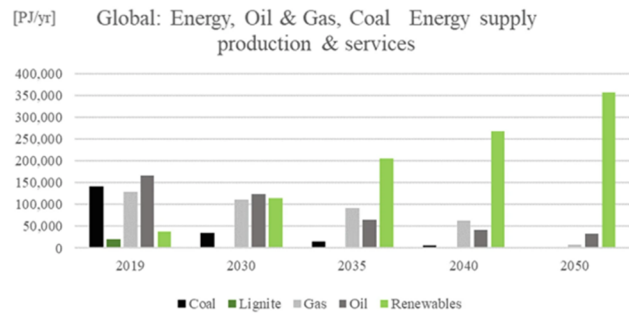
There are substantial changes in greenhouse gas emissions by sector. The energy sector and the IPPU (Industrial Processes and Product Use) sector (International Energy Agency, 2024) have increased in both quantity and proportion of carbon emissions, whereas the AFOLU (Agriculture, Forestry, and Other Land Use) sector has witnessed a decrease, as a result of advancements in the sector. Despite a reduction in overall contribution to emissions, there is still an increase in carbon emissions from the waste sector.

2.4 Present solutions to reduce carbon emissions

Solutions to reduce carbon emissions include enhancing fuel efficiency, using renewable energy sources, optimising supply chains, and implementing waste reduction and diversion strategies. (United States Environmental Protection Agency, 2025). Supplementary solutions include afforestation, judiciously using agricultural soil and using the crop rotation method to keep the soil fertile, executing biomass removal and storage methods, and employing Direct Air Capture (DAC).

Mulligan, n.d. Alternative solutions to reduce carbon emissions include implementing environmental management systems, using digital documents to replace paper consumption, encouraging carpooling among people, and subsidizing public transportation for less usage of private vehicles. (Strategies for Mitigating Your Emissions | UNFCCC, n.d.)

2.5 Global predictions of GHG drivers



Source: Teske, S. et al. (2022). Scopes 1, 2, and 3 Industry Emissions and Future Pathways

The GHG emission drivers are expected to reduce, and renewable energy will be prevalent globally by 2050. To reduce carbon emissions, the government and private entities will adopt renewable energy practices. This will involve reducing the supply of greenhouse gas producers like coal, lignite, gas, and oil.

2.6 Indian government initiatives to reduce carbon emissions.

The ISA is a joint project between France and India that aims to coordinate efforts to use solar energy solutions to fight climate change. It was conceived during COP2, 2015, in Paris. The Indian government pledged to become net zero by 2070 by introducing 5 major climate action plans:

1. To achieve a non-fossil energy capacity of GW by 2030,
2. Renewable energy will generate 50% of India's energy requirements
3. Reduce total projected carbon emissions by 1 billion tonnes by 2030
4. Lower carbon intensity of the economy by 45% by 2030 compared to 2005 levels
5. Reach net zero emissions by 2070. (*Climate Change Policies and India's Road to Net-Zero*, n.d.)

Future fuels are anticipated to be hydrogen and ammonia. The new Hydrogen initiative aims to utilize solar electricity to produce green hydrogen (Only One Earth, n.d.) and green ammonia. By 2030, it will contribute to the goal of producing 5 million tons of green hydrogen. Additionally, the government approved the Green Energy Corridor, which establishes the infrastructure to connect renewable energy sources to the electrical grid. This plan will help achieve the goal of 450 GW of in-

stalled renewable energy capacity by 2030. Furthermore, India has progressed from BS-IV to BS-VI fuel and vehicle standards to reduce vehicle emissions. (*Only One Earth: Initiatives Towards a Climate Compatible Future*, n.d.).

Results and Discussions

Carbon emissions are rising globally each year, posing a serious concern. In response, 196 countries signed the Paris Agreement (UNFCCC (Key Aspects of the Paris Agreement, n.d.), n.d.) in December 2015, committing to limit global warming this century to well below 2°C above pre-industrial levels and further reduce the temperature increase to 1.5°C. This requires a significant initiative by all countries and their people, adoption of innovative technologies, effective resource mobilisation and its judicious use. India ratified the Paris Agreement in October 2016 to combat increasing greenhouse gas emissions. These emissions significantly affect human lifestyles, biodiversity, ocean acidity, extreme weather phenomena, rising sea levels, and poverty and displacement.

India is the third-highest carbon-emitting country. Primary sectors responsible for this are the Energy and Industrial sectors, as these sectors rely heavily on fuel usage. Other sectors like AFOLU, transportation and the construction sectors are other major sectors contributing to these emissions.

We observe that the Energy and Industrial sector emissions have risen in both percentage as well as volume, but in case of AFOLU, emissions have been reduced. Solution to reduce emissions are being globally implemented and India should take proactive approach in order to curb the rising emissions. Yet a significant change is required to reduce the emissions which can be done by not only government policies but also efforts of people. These efforts can be similar to adopting green products. (Bhattacharya & Banerjee, 2024).

There is an urgent need to shift to renewable energy sources and advance technologies to reduce emissions from large emitting sectors. This involves upgrading equipment, optimising processes, and implementing energy-saving techniques. (Huffman & Huffman, 2023)

Transitioning from fossil fuels to renewable energy sources requires a significant effort and cost in terms of initial installation costs, power storage difficulties, limited knowledge and awareness.

One of the viable solutions to mitigate carbon emissions is Direct Air Capture (DAC). Direct Air Capture (DAC) systems directly separate carbon emissions from industries and store them below the surface of the earth or transform them into diverse products. This technology is currently being implemented in various countries like the United States, Canada, Japan, and the United Kingdom. Upon achieving maximum potential, it will reduce carbon emissions by a significant amount, equal to eliminating over 1,16,000 gasoline-powered vehicles from the road each year.

Despite its potential to reduce emissions, DAC face obstacles from required innovation and related expenses. These costs include the expense of power, equipment, chemicals, and storage, which are very high and thus difficult to implement. (Lebling, n.d.)

To combat these challenges, it is necessary to have a holistic strategy i.e. government initiatives are important but individual efforts are equally important. This task is not the sole responsibility and burden of the government, it requires all its citizens to act towards achieving these goals. Individually, we can take actions to reduce carbon emissions by conserving energy at home, walking or using public transportation, shifting to electric vehicles, and minimising, reusing, repairing, and recycling electronics, clothing, plastics, and other materials which lead to increased emissions. In addition to this, we need to raise awareness with respect to this global issue and motivate others to adopt these practices. (United Nations, n.d.). Governments have been consistently working towards curbing carbon emissions, and now it is time for individuals to also act and adopt eco-friendly practices. This transition requires that businesses create high-quality, eco-friendly products at competitive prices to facilitate the adoption of these products.

Conclusion

Urgent action is required from all the nations to address the global problem of carbon emissions. India, with the goal of achieving net-zero carbon status, has to travel a long way to combat the emissions from sectors like energy and the industrial sector, which heavily depend on fossil fuels, before they reach their desired goal. The transition to renewable practices from conventional practices is the need of the hour, but the required speed of change is being hindered by multiple constraints. India must implement various policies and take action to reduce and eliminate constraints. Policymakers must keep in mind Jevons' Paradox, which states that the developments in technology which results in more efficiency would result in more consumption and thereby not lead to the expected results. This paradox results in reduced costs per consumption, which leads to more consumption and appeals more individuals to use this technology. This requires a mental revolution from consumers, as they should understand the importance of the environment and use eco-friendly products. By making rational choices, individuals can contribute to a more sustainable future. This collective effort, involving individuals, businesses, and the government, can transform the world into a better place.

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