International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Perspective Study on Emission of Greenhouse Gases with relation to Climate Change in India

Dr. V. Sumathi[1], Ms. V. Yuvathi Porkkamalam[2]

[1]Assistant Professor, Department of Economics
[2]Ph D Research Scholar, Department of Economics, PSG College of Arts & Science Coimbatore

Abstract
India has made significant progress towards meeting its emissions reductions under the Paris Agreement. With current policies, total GHG emissions would nonetheless increase by more than 40 per cent by 2030. A modest increase in short-term emissions is necessary to meet poverty reduction and energy security goals. A more rapid scaling up of current policies help lower emissions considerably over the medium-term and bring India a closer to a path to net zero by 2070. Total greenhouse gas emissions are the sum of emissions of various gases such as carbon dioxide, methane, nitrous oxide, hydrofluorocarbons. The greenhouse gas emissions from human activities are driving climate change and continue to rise. The world must transform its energy, industry, transport, food, agriculture and forestry system to ensure the cost savings policies to cut greenhouse gas emissions. This study focused on emission of greenhouse gases from agriculture, industrial processes, energy and its impact on climate change. Secondary data related to emissions were collected for 20 years. Statistical tools such as annual growth rate, compound annual growth rate was used for analysis. This study helps to find out the emission of gases that lead to climate change in India.

Keywords: Greenhouse gas emissions, Climate change, Paris Agreement

Introduction

Climate Change is referred to changes in the Earth's climates, at local, regional, or global scales, and the effects of these changes. In recent decades, the term 'climate change' is most often used to describe changes in the Earth's climate driven primarily by human activity since the pre-Industrial period particularly the burning of fossil fuels and removal of forests, resulting in a relatively rapid increase in carbon dioxide concentration in the Earth's atmosphere. India emits about 3 giga tons of greenhouse gases each year. Emissions must fall by 45 per cent under current policies to get on a least-cost pathway to hold global warming to 1.5^0 C.

Greenhouse Gas

A Greenhouse gas is a gas that traps heat in the atmosphere. Greenhouse gas emissions fell 9 per cent from 2019 to 2020. The primary greenhouse gases generated by humans are carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O) and "fluorinated gases" such as hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride and nitrogen trifluoride.

Carbon dioxide (CO_2)

Carbon dioxide (CO_2) is the most abundant greenhouse gas, that is emitted primarily through the burning of fossil fuels in motor vehicles as fuel or in powerplants to generate electricity and through other sources such as solid waste, biological materials and chemical reactions.

Methane (CH_4)

Methane is released into the atmosphere by both natural sources such as wetlands and by human activities. Human-generated sources of methane include natural gas production, coal mining, wastewater treatment and landfills.

Nitrous oxide (N_2O)

Nitrous oxide is primarily released through agricultural soil management practices (74%) such as the application of fertilizer, chemical production, the combustion of fossil fuels and the treatment of wastewater.

Fluorinated gases

Fluorinated gases are entirely man-made gases generated by various chemical and industrial processes. 93 per cent of the fluorinated gases released into the atmosphere come from their use in various industrial roles.

Impacts:

Reduced Agricultural Output: Climate change can severely disrupt crop cycles and cause low agricultural yield due to changes in temperature, precipitation patterns, pest infestation, soil erosion, water scarcity, and extreme weather events such as floods and droughts. Agriculture is the largest source of livelihood in India and contributes significantly to the economy. Low yields can hit the rural economy and push inflation in urban areas as well.

Damaged Infrastructure: Climate change can damage physical infrastructure such as roads, bridges, railways, ports, airports, power plants, water supply systems, and buildings due to sea level rise, coastal erosion, landslides, storms, floods, and heat waves. Damaged infrastructure can disrupt economic activity, trade, and connectivity and increase maintenance and replacement costs.

Reduced Industrial Output: Climate change can increase operational costs and reduce profits in the industrial sector due to factors such as new climate-friendly regulations, reduced utilisation of old stock, relocation of production processes and activities due to climate-related losses. India could contribute to 34 million out of 80 million global job losses due to heat stress-associated productivity decline by 2030.

Panchamrit: India has presented the following five nectar elements (Panchamrit) of India's climate action:

1. Reach 500 GW Non-fossil energy capacity by 2030.
2. 50% of its energy requirements from renewable energy by 2030.
3. Reduction of total projected carbon emissions by 1 billion tonnes from now to 2030.
4. Reduction of the carbon intensity of the economy by 45% by 2030, over 2005 levels.
5. Achieving the target of net zero emissions by 2070.

The impact of climate change can be reduced by India the following ways.

Enhancing Carbon Sequestration: India can enhance its carbon sequestration potential by expanding its forest and tree cover, restoring degraded lands, promoting agroforestry, and adopting low-carbon farming practices.

Carbon sequestration offset emissions and provide multiple co-benefits such as biodiversity conservation, soil fertility improvement, water security, livelihood support, and disaster risk reduction.

Building Climate Resilience: ndia can build its climate resilience by strengthening its disaster management systems, improving its early warning and forecasting capabilities, investing in climate-proof infrastructure, developing climate-smart agriculture, enhancing health care services, and empowering local communities and institutions.

Climate Smart Agriculture: There is a need to encourage sustainable farming practices by promoting organic farming, agroforestry, and precision agriculture. Integrating technology-driven solutions such as remote sensing, IoT devices, and AI-based analytics can optimise resource utilisation, reduce water consumption, and enhance crop productivity.

Statement of the problem

Climate change is a problem that have great impact on the economy. climate change–induced hazards pose an imminent threat to the food security and livelihoods of millions of people across the world. Therefore, this study is made to find out the greenhouse gas emissions that lead to climate change problem in India.

Objectives

- To find out the sectoral emission of greenhouse gases that lead to climate change in India.
- To examine the changes in emission of greenhouse gases.

Review of Literature

Jones et al., [1](2023) discussed about the national contributions of climate change due to historical emissions of carbon dioxide, methane and nitrous oxide. The emission of greenhouse gas made significant contributions to global warming and targeted international climate policy. The use of fossil carbon sources in several sectors lead to increased atmospheric concentrations.

Sharma [2](2022) made empirical analysis about the climate change over India. Climate change policies like COP26 often meet reluctance and stress the economy. The study highlighted the climate variations and made suggestions about adopting green goals and green economy.

Malhi, Kaur et al.,[3] (2021) analyzed the impact of climate change on agriculture. Climate change is the result of increase in greenhouse gases such as methane, carbon dioxide and nitrous oxide. The fertilization of crops is increased due to increased level of CO2. Conservation agriculture leads to lower GHG emissions, reduced fertilizer uses and higher terrestrial carbon sequestration.

[1] Jones, M.W., Peters, G.P., Gasser, T. et al. (2023) "National contributions to climate change due to historical emissions of carbon dioxide, methane, and nitrous oxide since 1850", Scientific Data 10, 155.

[2]Sharma M, Singh R, Kathuria A. (2022) "Climate Change and the Indian Economy - A Review". Current World Environment 17(1) March, pp 20-31.

[3] Malhi, Kaur et al., (2021) "Impact of climate change on agriculture and its mitigation strategies: A review" Sustainability 13 (3) pp 1-21.

Althor et al.,[4] (2016) made study about the mismatch of greenhouse gas emissions and burden of climate change. The analysis was made between the countries which emit more greenhouse gases and between less emitting countries. Less emitting countries affected due to more emitting countries. It was found that GHG emission countries are vulnerable to negative impacts of climate change.

Vijay Gupta [5](2005) suggested that climate change could manifest itself in gradual changes in temperature, precipitation and rise in sea level. The study discussed about the future emissions scenarios in India highlighting the India's vulnerability to climate change and analyzed the initiatives undertaken to mitigate GHG emissions

Methodology

The study is both descriptive and analytical in nature. The study is based on secondary data. The secondary data related to total greenhouse gas emissions from agriculture, industrial processes, energy for India were collected for 20 years i.e, from 2001 to 2020.The secondary data were collected from the source Climate Watch (World Bank Data).

Statistical Tools Used

Statistical tools like Annual Growth Rate, Compound Annual Growth Rate were used for analysis.

Annual Growth Rate

Annual Growth Rate is the average increase or decrease in the value over a specific period of time. The average annual growth rate is determined by taking the numerical mean of specified year-on-year growth rates.

Formula

Annual Growth Rate (AGR) = ((Yt - Y0) / Y0 * 100)

Compound Annual Growth Rate

Compound Annual Growth Rate is the mean annual growth rate over a specific period of time. It is often used to measure and compare the past performance of investments or to project their expected returns.

Formula

Compound Growth Rate (CGR)= (((Yt / Y0) ^(1/t)– 1) *100)

Analysis

The total greenhouse gas emissions in India from agricultural sector from 2001 - 2020 had been given in table 1.

[4] Althor, G., Watson, J. & Fuller, R. (2016) "Global mismatch between greenhouse gas emissions and the burden of climate change.", Scientific Reports 6, 20281.

[5] Vijaya Gupta (2005) "Climate Change and Domestic Mitigation Efforts", Economic & Political Weekly 40(10) March, pp 981-987.

Table 1 Greenhouse Gas Emissions from Agriculture

YEAR	TOTAL GREENHOUSE GAS EMISSIONS (IN METRIC TONS)	AGR
2001	622.53	-
2002	606.55	-2.63
2003	618.2	1.88
2004	627.82	1.53
2005	647.21	3.00
2006	661.96	2.23
2007	679.15	2.53
2008	686.84	1.12
2009	680.88	-0.88
2010	690.93	1.45
2011	701.3	1.48
2012	695.13	-0.89
2013	697.67	0.36
2014	699.2	0.22
2015	703.94	0.67
2016	705.65	0.24
2017	712.6	0.98
2018	721.96	1.30
2019	728.42	0.89
2020	741.92	1.82
CAGR		0.88

Source: Climate Watch

Interpretation

The total greenhouse gas emissions in India from agriculture for 20 years were represented in Table 1 and Annual Growth Rate and Compound Annual Growth were calculated. The highest emission of greenhouse gas was in the year 2020 i.e., 741.92 metric tons. The emission of gases was increasing due to increase in agricultural production for coping up to meet the increased demand for food and other raw materials due to rise in population. The Compound Annual Growth Rate of Emission of Greenhouse gases for 20 years was 0.88 which indicates that emission of greenhouse gases from agriculture did not increase to higher extent. The emission of gases from agriculture had less impact on climate change.

Table 2 Greenhouse Gas Emissions from Industrial processes

YEAR	TOTAL GREENHOUSE GAS EMISSIONS (IN METRIC TONS)	AGR
2001	**58.29**	
2002	**60.7**	3.97
2003	**62.51**	2.90
2004	**67.2**	6.98
2005	**71.39**	5.87

2006	**77.08**	7.38
2007	**80.97**	4.80
2008	**86.35**	6.23
2009	**94.85**	8.96
2010	**100.08**	5.23
2011	**106.23**	5.79
2012	**115.99**	8.41
2013	**124.45**	6.78
2014	**133.32**	6.65
2015	**135.89**	1.89
2016	**143.31**	5.18
2017	**142.62**	-0.48
2018	**162.24**	12.09
2019	**168.55**	3.74
2020	**149.37**	-12.84
CAGR		4.82

Source: Climate Watch

Interpretation

The total greenhouse gas emissions in India from industrial processes for 20 years were represented in Table 2 and Annual Growth Rate and Compound Annual Growth were calculated. The highest emission of greenhouse gas was in the year 2019 i.e., 168.55 metric tons. The emission of gases was increasing due to increase in industrial production as manufacturing is the most important sector and accounts for 78 percent of total production. The Compound Annual Growth Rate of Emission of Greenhouse gases for 20 years was 4.82 which indicates that emission of greenhouse gases from industrial processes increase at faster rate. The emission of gases from industrial processes had more effect on climate change.

Table 3 Greenhouse Gas Emissions from Energy

YEAR	TOTAL GREENHOUSE GAS EMISSIONS (IN METRIC TONS)	AGR
2001	**998.63**	-
2002	**1030.73**	3.11
2003	**1057.85**	2.56
2004	**1130.42**	6.42
2005	**1179.63**	4.17
2006	**1256.18**	6.09
2007	**1378.65**	8.89
2008	**1465.93**	5.95
2009	**1608.48**	8.86
2010	**1703.7**	5.59
2011	**1798.74**	5.28
2012	**1945.03**	7.52
2013	**2001.1**	2.80

2014	**2172.27**	7.88
2015	**2184.34**	0.55
2016	**2217.71**	1.50
2017	**2332.28**	4.91
2018	**2468.71**	5.53
2019	**2431.19**	-1.54
2020	**2224.18**	-9.31
CAGR		4.09

Source: Climate Watch

Interpretation

The total greenhouse gas emissions in India from energy for 20 years were represented in Table 3 and Annual Growth Rate and Compound Annual Growth were calculated. The highest emission of greenhouse gas was in the year 2018 i.e., 2468.71 metric tons. India is the third largest global emitter of carbon dioxide. The emission of gases was increasing as energy consumption had more than doubled, propelled upwards by a growing population. The Compound Annual Growth Rate of Emission of Greenhouse gases for 20 years was 4.09 which indicates that emission of greenhouse gases from energy increase at faster rate. India's industrialization and urbanization would make huge demands of energy sector. The emission of gases from energy had been one of the main reasons of climate change.

Findings

1. The highest emission of greenhouse gas was in the year 2020 i.e., 741.92 metric tons. The emission of gases was increasing due to increase in agricultural production for coping up to meet the increased demand for food and other raw materials due to rise in population. The Compound Annual Growth Rate of Emission of Greenhouse gases for 20 years was 0.88 which indicates that emission of greenhouse gases from agriculture did not increase to higher extent. The emission of gases from agriculture had less impact on climate change.
2. The highest emission of greenhouse gas was in the year 2019 i.e., 168.55 metric tons. The emission of gases was increasing due to increase in industrial production as manufacturing is the most important sector and accounts for 78 percent of total production. The Compound Annual Growth Rate of Emission of Greenhouse gases for 20 years was 4.82 which indicates that emission of greenhouse gases from industrial processes increase at faster rate. The emission of gases from industrial processes had more effect on climate change.
3. The highest emission of greenhouse gas was in the year 2018 i.e., 2468.71 metric tons. India is the third largest global emitter of carbon dioxide. The emission of gases was increasing as energy consumption had more than doubled, propelled upwards by a growing population. The Compound Annual Growth Rate of Emission of Greenhouse gases for 20 years was 4.09 which indicates that emission of greenhouse gases from energy increase at faster rate. India's industrialization and urbanization would make huge demands of energy sector. The emission of gases from energy had been one of the main reasons of climate change.

   India's contribution to historical cumulative CO_2 emissions is 3 per cent from 1850 to 2019.

Conclusion

Greenhouse gas emissions and the global average temperature are hitting new highs and extreme weather

events are becoming more intense. Cattle, coal power plants, rice paddies are the country's major sources of emissions that continue to rise rapidly. If warming increases 2^0C to 3^0C, it is likely that there will be irreversible changes to the climate systems. A warmer climate brings a host of risks from increased drought and wildfires that leads to rise the sea levels and heat-related illnesses. Under the Paris Agreement, countries collectively agreed to reduce their emissions and take national climate action plans that include different types of targets for reducing greenhouse gas emissions.

References

1. Althor, G., Watson, J. & Fuller, R. (2016) "Global mismatch between greenhouse gas emissions and the burden of climate change.", Scientific Reports 6, 20281.
2. Jones, M.W., Peters, G.P., Gasser, T. et al. (2023) "National contributions to climate change due to historical emissions of carbon dioxide, methane, and nitrous oxide since 1850", Scientific Data 10, 155.
3. Malhi, Kaur et al., (2021) "Impact of climate change on agriculture and its mitigation strategies: A review" Sustainability 13 (3) pp 1-21.
4. Sharma M, Singh R, Kathuria A. (2022) "Climate Change and the Indian Economy - A Review". Current World Environment 17(1) March, pp 20-31.
5. Vijaya Gupta (2005) "Climate Change and Domestic Mitigation Efforts", Economic & Political Weekly 40(10) March, pp 981-987.