



Consequences of Greenhouse Gases (GHG) on Global Warming and its Scientific Preventing Measures

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ABSTRACT:

The surface of the Earth heats naturally due to the greenhouse effect. The main contributing factors to global warming are greenhouse gases, which include water vapour, Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone, and some synthetic chemicals like chlorofluorocarbons (CFCs). The earth's surface and environment are warmed by the heat that was received. The temperature of the earth is being kept at a high degree Celsius warmer than it would be. The greenhouse effect is brought on by these gasses' capacity to hold warmth. (The royal society, climate change 2010). Since it prevents some of the planet's heat from escaping from the atmosphere and into space, the Greenhouse effect plays a major role in maintaining Earth's temperature. The greenhouse effect, which eventually results in global warming, is caused by these greenhouse gases. This essay focuses on the sources of greenhouse gases, their effects on global warming, and mitigation strategies for the greenhouse effect.

Keywords: *Greenhouse gases, global warming, sources, prevention*

I. INTRODUCTION

The natural atmospheric greenhouse effect is crucial to maintaining existence on the Earth. It is the end consequence of a mechanism whereby the stratosphere of the planetary catches solar energy and heats the surface of the planet. In the tropics, or lower atmosphere layer, where weather and life exist, the greenhouse effect takes place. The mean temperature at the earth's surface is currently 14 degrees Celsius, but without the greenhouse effect, it is expected to be closer to -19 degrees Celsius (Le Treut et al, 2007). Gases that cause the greenhouse effect are called greenhouse gases (GHG). The gaseous atmospheric components known as GHG absorb and release heated infrared light (IPCC, 2014). The troposphere contains small amounts of GHG, either naturally occurring or man-made. Water vapour, Carbon Dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), and Ozone are the most prevalent GHGs in terms of greenhouse impact, in that order (O₃). (Williams et al 2017). The way that "greenhouse gases" trap heat near the surface of the Earth is known as the greenhouse effect. The earth is kept warmer than it would be without these heat-trapping gases, which can be compared to a sheet. (NASA, 2018). Global warming is the rise in global average temperatures brought on by the greenhouse effect. When sunlight heats the earth's surface, many atmospheric gases function like glass in a greenhouse, trapping the heat as it radiates back into space. Earth's temperature rises as a result of the atmospheric formation of greenhouse gases. Rapid environmental degradation, and global warming, is the result of this phenomenon.

II. SOURCES OF GREENHOUSE GASES (GHG)

The primary cause of the greenhouse effect is greenhouse gases (GHG). GHG are the gaseous atmospheric elements that absorb and emit thermal infrared radiation (IPCC, 2024). This enables these gases to capture atmospheric heat and then transmit it to the surface, further warming the planet (Archer, 2007). This continual process of retaining heat points to an increase in global temperatures as a whole. The process, which closely resembles how a greenhouse operates, is the primary justification for the term "greenhouse gases," which refers to all gases that potentially result in this outcome (Maria, 2019). As seen in the following figure, these greenhouse gases are artificially produced;

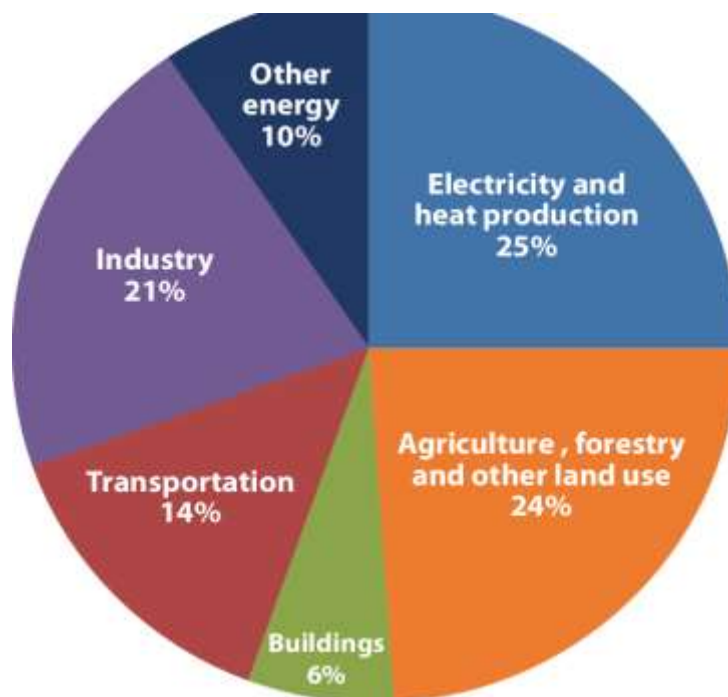


Fig. 2.1 global greenhouse gas emission by sector (<https://www.researchgate.net/figure/Global-greenhouse-gas-emissions-by-sector>)

2.1 Water vapour:

Both clouds and vaporized water are found in the troposphere. Although water vapour is the most powerful greenhouse gas in the Earth's atmosphere, it behaves very differently from the other greenhouse gases. Water vapour's main function in the climate system is not as a direct agent of nuclear forcing but as a climate feedback, or a reaction inside the climate system that affects the system's continuous activity. Such difference results from the fact that, in general, social activity never effectively alter the amount of water vapour in the atmosphere; rather, average temperatures determine its concentration. Water evaporates from surfaces more quickly the warmer they are. The higher quantity of water vapour, which can absorb thermal energy and radiate it back to the surface, can be found in the lower atmosphere as a result of enhanced evaporation. Yet, comparing towards other GHGs like Carbon dioxide, such as days, water vapour's stratospheric lifespan is brief (IPCC, 2014).

2.2 Carbon Dioxide (CO₂):

50 percent of the greenhouse impact is caused by Carbon dioxide. One carbon atom with an oxygen atom attached to each side makes up the substance (IPCC, 2014). The carbon dioxide molecule may catch infrared rays as soon as its atoms are closely bound collectively, and the molecule then begins to oscillate. The radiation will ultimately be released once more by the oscillating molecules, and it will probably be captured by still another greenhouse gas molecule. This sequence of absorbing, ejection, and uptake keeps heat near the surface, effectively protecting it from the coldness of space. (Shine et al 2016.). Burning fossil fuels (coal, natural gas, and oil) releases carbon dioxide into the atmosphere, along with other gases and by-products of other biological processes like deforestation and solid waste (e.g., manufacture of cement). As part of the biological carbon cycle, carbon dioxide is absorbed by plants and then eliminated from the atmosphere. The figure below describes the emission of carbon dioxide and creating of global warming.

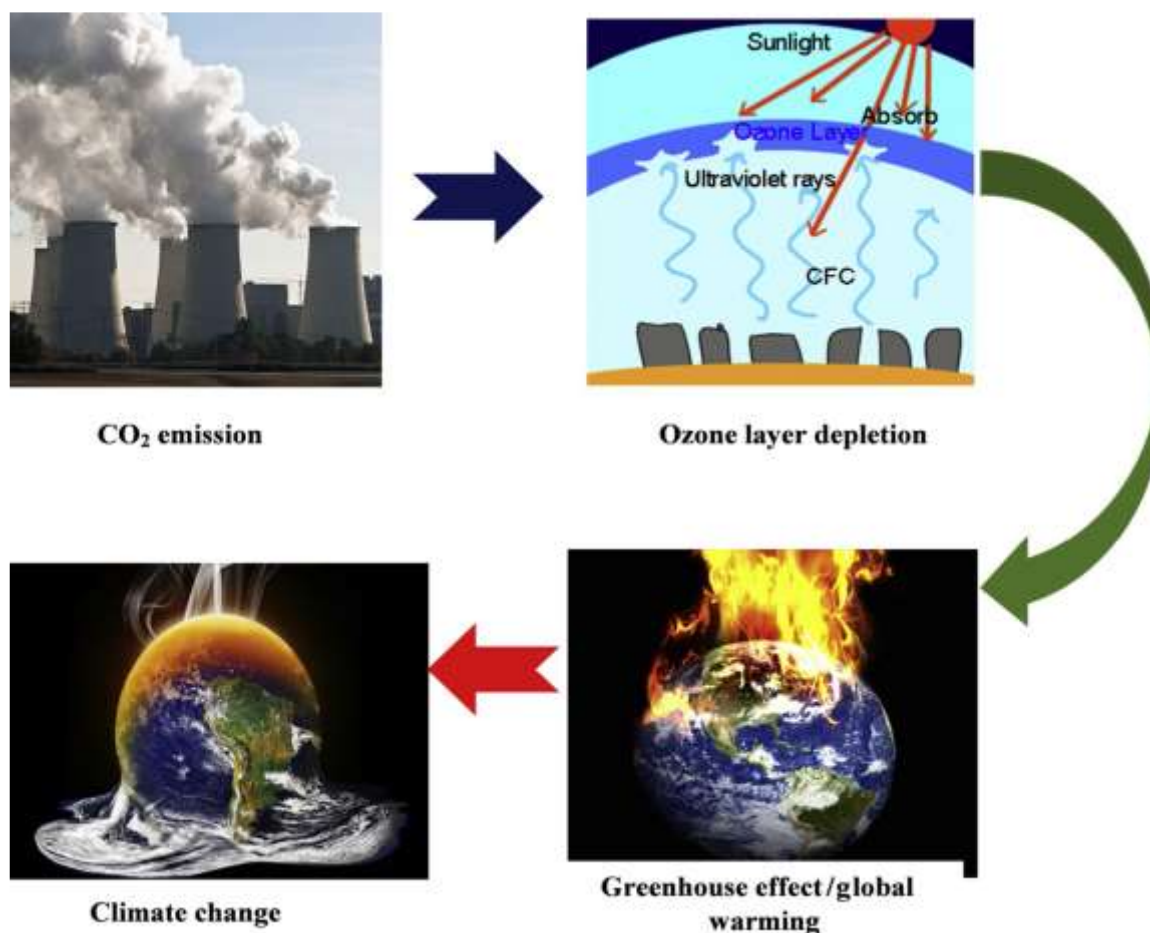


Fig. 2.2 CO₂ emission and global warming (<https://science.howstuffworks.com/environmental/green-science/carbon-capture.htm>, 2019).

2.3 Methane (CH₄):

Coal, natural gas, and oil are all produced and transported while emitting of methane. Animal husbandry, certain farm activities, as well as decomposition of organic waste in municipal solid waste landfills all contribute to methane emissions. (Acher, 2007).

2.4 Nitrous Oxide (N₂O):

Agricultural and industrial processes, the burning of fossil fuels and solid waste, as well as wastewater treatment, all produce emissions of nitrous oxide (Maria, 2019). Together with methane (CH₄) and carbon dioxide (CO₂), nitrous oxide (N₂O) is a troublesome greenhouse gas that has a high potential to produce the greenhouse effect. The generation of biogas results in large Nitrous oxide emissions, which considerably influence global warming. The selection of climatic parameters has a significant effect on the relative impact of Nitrous oxide upon this ecosystem. Yet, it is indisputable that if a global temperature with a temporal change potential of more than 100 years is used as the metric, the impact of Nitrous oxide can outweigh the impacts of carbon dioxide and methane. When organic nitrogen compounds, such as those found in human or animal waste, are present in wastewater, nitrous oxide can be released. (Raul C. *et al*, 2018).

2.5 Ozone (O₃):

Although ozone is a GHG, depending on where it is present in the earth's atmosphere, ozone can either be beneficial or destructive. Ozone organically originates in the ionosphere, a higher altitude of the atmosphere, where it creates a layer that prevents ultraviolet (UV) light, which is damaging to plants and wildlife, from penetrating the earth's surface. The protective advantage of stratospheric ozone surpasses its role in greenhouse gas emissions and global warming. Ozone is damaging to human health, but, at lower atmospheric altitudes (the troposphere). Ozone is produced in the stratosphere by industrial chemicals manufactured by humans, and this ozone can erode the ozone layer. (U.S EPA, 2020).

III. CAUSES OF GREENHOUSE GASES

The following are the main factors that responsible for the cause of greenhouse gases:

- Deforestation: this is considered to be most responsible factor for the cause of the greenhouse effect. This is due to the reduction in the release of oxygen and absorption of carbon dioxide by the plants.
- Fossil fuel burning: fossil fuels such as coal, oil, and natural gases are used as a means of energy which releases a huge amount of harmful gases into the environment.
- Population: As the population increases, the of space increases which again results in deforestation.
- Electricity production: Electricity production generates the largest share of greenhouse gas emissions. Approximately 63% of our electricity comes from burning fossil fuels, mostly coal and natural gas (U.S E.I.A 2019).

IV. CONSEQUENCES OF GHG TO GLOBAL WARMING

The term "global warming" describes both the impacts of the Earth's climate system's rising temperature. The Earth's temperature is indeed rising by 0.85°C, according to unambiguous scientific evidence. This has an influence that varies depending on the region. The effects include: a rising sea level, a rise in average temperature, Desertification, variable rainfall, and a divergence in seasonality characteristics.

- A. **Increase of Average Temperature:** This is the much frequent effect of greenhouse gases is global warming, which can raise the Earth's surface's average temperature. On land, the evaporation process is accelerated by the rising temperature. There are more severe droughts in many dry locations, as well as the western United States, Southern Africa, western Africa, and India (Raul. et al. 2018). As temperatures rise, more sea water evaporation occurs, increasing the likelihood of storms. This comprises hurricanes that are stronger, pacific typhoons that are more common, and severe localised storms and tornadoes that occur more frequently. As a result, flooding and property destruction are occurring more frequently in America and the eastern coastline region of Asia. Since 1970, there is now twice as much Earthly territory that is experiencing droughts. In spite of a projected 10 percent increase in worldwide rainfall, this has happened. Because Carbon dioxide concentrations have increased significantly since the pre-industrial era, it is predicted that the global mean temperature would rise by 1.5°C to 4.5°C (IPCC, 2014). As comparison to the period 1950–1989, the present change in temperature is approximately 0.88°C, although India in particular had a change of 1.02°C over that time. It is due to the growth of the industrial sector and the intensive farming practises required to sustain a larger population density. Since it affects the entire northern hemisphere across the entire time span, this rate of warming is not only spatially temporally. According to the model, warming is predicted to be greater in higher latitudes than lower latitudes and to be more pronounced in the winter than in the summer. Since 1980, there has been a significant transformation. Since then, both the average temperature and the Carbon dioxide concentration have been rising at the same time. Numerous factors, including industrialisation, extensive use of non-renewable energy, agricultural practises (land use pattern), and others are to blame for this growth, which results in numerous adjustments to the hydrological processes, rise in sea levels, and other factors.
- B. **Sea Level Rise:** There will be an increase in sea level as a result of two main mechanisms if global warming occurs. Because to the seawater's thermal expansion, warmer temperatures firstly cause the sea level to increase. Moreover, the ocean would be refilled with water as a result of melting glaciers and ice sheets in Greenland and Antarctica. According to projections, between 1990 and 2100, the average sea level on Earth will rise by 0.09 to 0.88 metres. (T. Latake, et al, 2015).
- C. **Rainfall Patterns Have Changed:** The atmosphere's layers are ultimately heated by greenhouse gases, and the layer-by-layer contrast warming of the weather is what primarily determines the difference in pressure that controls the rainfall system and its amount. Whenever the air crosses a water body, which occurs when it moves from a high to a low pressure area, it turns into a source of rain (Rogger, 2019). The rise in the mean temperature has a significant impact on the pressure region, which in turn affects the direction of the wind and, eventually, the pattern of rainfall. Temperature anomalies during the past century show a pattern where some areas received significantly more rainfall than others, while in many other areas the trend of rainfall does not obey any consistent link.
- D. **Adjustments in Seasonal Characteristics:** Around the world, it has been noticed that seasonal characteristics have undergone significant change or shift as a result of changes in air temperature and rainfall patterns. Winters have been longer and icier in many regions, and summers have become hotter and stifler in others. Because unpredictability is more prevalent, there is less reliance on the weather. In India, for instance, summer rainfall and pre-monsoon showers have reduced atmospheric concentrations of greenhouse gases. (Norwegian Inter-ministerial Climate Group 1992).
- E. **Effect on the Hydrological Process:** Amount of rainfall is probably going to get heavier globally. The future of regional seasonal rainfall is unknown, though. It's possible that certain areas receive more rain than others. Additionally, evaporation is likely to be increased by warmer temperatures. Several flood control agencies might likely experience more struggle as a result of these developments. (T. Latake, et al, 2015).
- F. **Mobility of Species:** Due to the primary geographical trends that have been impacted by the gradual rise in temperature, many animal species will be compelled to relocate. (IPCC, 2014). The World Bank estimates that by 2050, 120 million individuals may have been compelled to flee their homes because to severe droughts or destructive floods, which may also require human beings to relocate.
- G. **Effect on Agriculture and Livestock:** The significant portion of the world's agricultural seasons have already changed as a result of GHG-induced global warming. Similar to how seasonal and temperature shifts affect the growth of invasive weeds and diseases that can harm

agriculture (IPCC, 2014). The same is true for livestock; environmental modifications have a significant impact on major animals in a variety of ways, including reproductive, metabolism, etc.

- H. **Virus Transmission and Epidemics:** According to the World Health Organization (WHO), global warming has contributed to the transmission of infectious like cholera, malaria, and other illnesses. On the other side, the excessive heat brought on by GHG will worsen and raise cardiovascular and respiratory issues. (IPCC, 2014).

V. PREVENTING MEASURES

Since the majority of the issue is universal and no one nation or group of countries can offer a specific solution. Prevention of GHGs is crucial for the worldwide. For this reason, regional and international collaboration are growing in demand and have been strongly supported by the community of global atmospheric sanity. Consequently, the United Nations Framework Convention on Climate Change (UNFCCC) went into effect to address the world's climate challenge. To minimise the harmful concentration of anthropogenic GHGs in the atmosphere, this was carried out in the form of a global accord involving various nations from various regions.

A. methodology for clean development

In order to further the concept of environmentally friendly growth, hygienic innovation mechanisms entail the widespread application of green energy technologies for power generation and carbon dioxide absorption. Together with its potential to reduce greenhouse gas emissions, renewable energy sources are also quickly advancing towards ensuring energy security (T. Latake, et al, 2015). The development of renewable energy sources is taking place more aggressively in developing nations.

B. Funding of low carbon intensity

A significant amount of greenhouse gas, such as Carbon dioxide, is released into the environment when petroleum products are burned (T. Latake, et al, 2015). Capacity and quality to contemporary energy is essential to growth as a key development component. With the widespread recognition of the need to reduce energy-related emissions, funding low-carbon energy can be utilised as a technique to cut greenhouse gas emissions. Although there are numerous financial programmes available for energy projects, funding low-carbon projects is essential, particularly in nations where oil is the primary source of income and energy production. Reduces the vulnerability of the human environment's sustainability when powered by low-polluting energy technology.

C. Benchmark for green energy

A sort of traditionally produced energy called "green energy" has less of an adverse influence on the environment. It's also known as renewable energy or green energy. Using renewable energy is now a crucial component that plays a big part in the mission to reduce greenhouse gas emissions and boost the likelihood of sustainable development. To generate and consume power with the least amount of pollution, numerous nations have implemented and funded green energy programmes. A legislation known as the "green energy portfolio standard" (GEPS) aims to increase the production and use of energy from cleaner suppliers with the lowest possible level of polluting susceptibility.

In some nations where the green energy portfolio standard is strongly supported, electric power producing businesses are required to supply a specific portion of the country's electricity consumption from renewable sources as a tactical approach to reduce emissions. Countries are required by the Intergovernmental Panel on Climate Change (IPCC) to report their emissions from all types of energy-related activities. Innovation, pollution reduction, and the potential for competition to eventually drive down the cost of renewable energy per unit were among the advantages mentioned by GEPS proponents. Green energy development that is sustainable can benefit the environment greatly while preserving fossil fuel resources for future generations.

D. Introducing of green wall

Planting more number of Trees is helpful in preventing against global warming, as the trees absorb carbon dioxide from the atmosphere can regulate the climate change, because a single tree can absorb one tone of CO₂ in its lifetime. (reva.edu.in).

E. Turn off Electronic devices:

Turning off electrical equipment like televisions, laptops, stereos, and music players while not in use can help save fuel used to create power, which can reduce the amount of CO₂ released into the environment by thousands of tonnes (reve.edu.in).

F. Using Energy-efficient devices:

Using energy-saving appliances, such as solar-powered showers and LED lights, can lower energy usage and contribute to the creation of clean energy (reve.edu.in). This is also the most affordable strategy to lower GHG emissions.

CONCLUSION

There is a critical and essential necessity scientific control against GHG (CO₂, CH₄, N₂O, O₃) emission reduction in all spheres of human activity, including power production and manufacturing. GHG emission, global warming, and their consequence (climate change) are severe environmental

challenges. According to this study, energy-related activities such as energy production and consumption have the ability to influence greenhouse gas emissions, which are the primary cause of looming global warming. Indeed, anthropogenic greenhouse gas emissions from energy-related human activities exceed those from other anthropogenic sources. The consequences and repercussions of greenhouse gases on global warming were also listed in the study. In essence, the study supported preventive strategies to strategically address GHG emission to avoid the sacredness of global warming for sustainable development. Furthermore, it endorsed the necessity of increasing the use of renewable energy, increasing the number of trees planted, shutting off electrical gadgets, and using energy-efficient technology to assist address issues related to greenhouse gas emissions and overall global warming.

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