



Climate Change and Global Warming: Realities, Concerns and Actions

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INTRODUCTION

Every year since 1992 has been among the hottest on record. The hottest year on record occurred in the globe in 2016 (Shen et al., 2022). With a focus on their effects on the environment, this article explores the ideas of CO₂ emission, global warming, and climate change. The chapter discusses current developments in the application of carbon capture and storage (CCS) technology to reduce greenhouse gas emissions, as well as various sources of atmospheric CO₂ emissions. This chapter presents CO₂ mitigation measures in specific industrial sectors, including electricity, cement, iron and steel, as well as the petrochemical industry, and explains the complex link between CO₂ emissions, global warming, and climate change. The focus was on a summary of process integration ideas for energy reduction in environmental sustainability studies. As future prospects in the use of process synthesis approaches to reduce the high energy and material requirements during CO₂ collection were indicated, the present status of research in this area was examined. Last but not least, the development of CO₂ emissions from the start of the first industrial revolution was examined together with current international agreements, restrictions, and projections for greenhouse gas emissions.

Causes of Global warming

There are several factors that contribute to global warming, including both man-made and natural factors.

2.1 Natural causes are those that are brought about by nature. Methane gas emissions from wetlands and polar tundra are one natural origin. Methane is a greenhouse gas that poses a serious threat to our planet. A gas that traps heat in the earth's atmosphere is referred to as a greenhouse gas. The cycle of climate change on earth is another factor. Typically, this climatic transition lasts for 40,000 years (Soeder 2021).

2.2 Manmade causes of global warming

Pollution is one of the most important problems brought on by humanity. Greenhouse gases are discharged into the air when fossil fuels are burned. By the year 2100, temperatures are predicted to rise by 2 to 6 degrees Celsius, a major increase from the current average temperature of 1.7 degrees Celsius, as a result of carbon dioxide emissions brought on by our usage of fossil fuels. (Lelieveld 2019).

Impacts of Global Warming

Increased likelihood of extreme weather events like heat waves, flooding, hurricanes, etc.; Sea level rise; Changes in rainfall patterns; Melting of ice caps and glaciers; Widespread extinction of animal population due to habitat loss; Spread of diseases like malaria; Coral bleaching; Loss of planktons due to warming of seas

Greenhouse effect

In balancing the cooling and warming of the globe, greenhouse gases are crucial. "The greenhouse effect is a naturally occurring phenomenon that heats the lower atmosphere of the planet and keeps it at a temperature where life may exist." The average temperature of the earth would be -19°C instead of its current value of 15°C , making it a frozen, lifeless planet. However, the greenhouse effect is a naturally occurring phenomenon. The natural equilibrium was disturbed by human-caused greenhouse gas emissions, which increased warming (Dong et al., 2021).

Incoming energy – Because the sun is incredibly hot, it releases energy that is delivered to Earth in high energy, short wavelengths that may pass through the atmosphere.

The atmosphere, clouds, and surface of the planet absorb 30% of the sun's energy before it is reflected back into space. The planet's atmosphere takes up the leftover solar energy. Through emission, the earth returns energy to the atmosphere. Because the earth is colder than the sun, the energy is emitted as infrared

radiations, which have a longer wavelength than the solar energy. Greenhouse gases have a key role in absorbing a large portion of the long-wave energy released from the planet's surface, keeping it from leaving the earth system. Greenhouse gases then radiate this energy throughout the atmosphere, warming the surface of the planet and the lower atmosphere.

Green House Gases

The average warming impact of naturally existing greenhouse gases is roughly 33 degrees Celsius (59°F). The main greenhouse gases are carbon dioxide (9–26%), methane (4–9%), ozone (3–7%), nitrous oxide (5–6%), and fluorinated gases. Water vapour accounts for 36-70% of the greenhouse effect. Clouds have an impact on the radiation balance as well, but because they are made of ice or liquid water, they have a different impact on radiation from water vapor.

Effect of global warming

Changes in the Earth's global mean temperature, sometimes referred to as global warming, cause the many effects of climate change. The IPCC has grouped many of these risks into five "reasons for concern:

1. Environmental changes
2. Damages from extreme weather events
3. Consequences that are disproportionately felt by developing countries
4. The underdeveloped nations, worldwide aggregate effects (i.e., different assessments of the entire social, economic, and ecological effects), and significant high-impact incidents.
5. Threats to endangered species and unique systems.

Ozone Layer Depletion

Three oxygen molecules make up the natural gas that produces ozone. Because of the way the ozone molecules are arranged, this ozone layer is crucial because it effectively absorbs UV rays, serving as a sunscreen. Ozone depletion over Antarctica, where only about

50% of the ozone that originally formed there remains. Only in 1985 did the ozone hole become a reality.

6.1 Ocean acidification

Ocean acidification is a shift in ocean chemistry caused by the ocean's absorption of carbon compounds from the atmosphere, which lowers ocean pH and increases hydrogen ion concentration. Due to ocean acidification, coral reefs cannot grow, plankton production is decreased, and fisheries are less productive. Marine ecosystems and the people who depend on them are increasingly being impacted by rising sea surface temperatures brought on by global warming. Due to the habitat's significant ecological importance and the striking visual phenomena of coral bleaching, which frequently occurs before coral death episodes, this is especially clear on coral reefs. In temperate coastal habitats, where arborescent corals, such those from the orders Alcyonacea and Antipatharia, frequently play an important structural function, reef-forming corals are less common. These corals have the ability to grow monospecific or mixed coral forests, which serve as repopulation, feeding, and nesting grounds for several related species.

6.2 Receding glaciers- symptoms of global warming change

In Glacier National Park, there were 147 glaciers 150 years ago, but there are now just 37, and scientists believe they will all certainly melt by 2030. Every year, glaciers in the Himalayas and Alps recede and vanish. Polar areas and high mountain habitats include 160,000 glaciers. Therefore, to regularly study the glaciers on our planet in a fraction of the time, researchers are increasingly adopting satellite remote sensors.

Global warming potential

The amount of total energy that a gas absorbs over a specific time period relative to carbon dioxide is known as its global warming potential. Methane has a lower global warming potential (GWP) than sulphur hexafluoride (SF₆), perfluorocarbons (PFCs), and

chlorofluorocarbons (CFCs) (Sovacool et al., 2021).

Impact of climate change

7.1 On Agriculture and food security

According to the analysis, decreasing water availability and an increase in pest/insect prevalence will result in lower agricultural yields in the majority of tropical and subtropical countries. By 2030, losses of numerous local staples, including rice, millet, and maize, might reach 10% in South Asia. The largest rivers in Asia are sourced from Himalayan glaciers, but if current trends continue, they may completely vanish by 2035, according to the International Commission for Snow and Ice. Although studies are conflicting and variety in rice cropping methods and meteorological circumstances hinders country-scale yield estimations, it is commonly predicted that climate warming would affect rice yields.

7.2 Impacts on Indian agriculture

By 2050, there would be a 10–20% decline in winter rainfall in Central India. Most crops' productivity may decline as a result of rising temperatures and declining water availability, particularly in the Indo-Gangetic plains. Rising temperatures would result in a greater need for fertilisers to achieve the same production goals, as well as higher GHG emissions, ammonia volatilization, and crop production costs. Decreased agricultural productivity was brought on by an increase in the frequency of droughts, floods, storms, and cyclones.

7.3 Water stress and water insecurity

Mountain glaciers and snow cover have decreased due to warming in both hemispheres, and this trend is expected to intensify during the 21st century. Sea level rise will make water shortages in coastal regions worse because it will cause groundwater sources to become more salinized (Wutich 2020).

7.4 Rise in sea levels

A 3–4°C rise in global temperature might cause flooding that would force 330 million people to relocate permanently. Cyclones will

hit Orissa harder. Numerous animals that inhabit the shoreline are also at danger. Flood dangers brought on by rising sea levels are shared by everyone who reside in the Ganga Delta (Fagherazzi et al., 2019). Red sea fan or red gorgonian, a species known as *Paramuricea clavata* has irregularly branching colonies that are purple or yellow in colour and has a lengthy lifespan of more than a century. This species is unique to the mesophotic zone of the Mediterranean Sea, where it creates coral woods that are extremely important ecologically and sustain a wide variety of species. The International Union for the Conservation of Nature has designated it as "vulnerable" and said that it is endemic to the basin.

7.5 Ecosystem and Biodiversity

Worldwide species, according to the World Wildlife Fund (WWF), are under danger from the tropics to the poles. According to WWF, a fifth of the most endangered natural places in the world may be in danger of experiencing a catastrophic loss of species. Mountains are a hotspot for biodiversity; nevertheless, as temperatures rise and due to human activity, mountains are being fragmented and degraded. Deserts are expanding and becoming more barren (Breed et al., 2019).

Future predictions:

The Antarctic ice sheet should grow, whereas the northern hemisphere cover should continue to decline. Between 9 and 88 cm should be added to the sea level. In terms of major countries, the United States tops the list of polluters of global warming.

CONCLUSION

Due to human emissions, extreme weather events are occurring more frequently. Heat waves, droughts, and changes in rainfall patterns are particularly expected to become more frequent. By the year 2100, temperatures are expected to climb 2 to 6 degrees Celsius beyond our current average of 1.7 degrees Celsius (IPCC). Sea levels may rise by 2.5 feet by 2050 and more than 4.5 feet by 2080 under

the current conditions. Global warming puts the world in peril in a fresh and unexpected way by causing earthquakes, tsunamis, avalanches, and volcanic eruptions. In less than one hour, subsequent storms like Irene would flood a large portion of the tunnels leading into Manhattan and engulf a third of New York City's streets.

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